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HE GREAT PYRAMID.

BY

PROFESSOR C. PIAZZI SMYTH, F.R.SS. L. & E.

ASTRONOMER-ROYAL FOR SCOTLAND.

With Photography, Map, and Plates.

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PREFACE.

THE following pages are the foundation of a paper which I had the honour of reading before the Royal Society of Edinburgh, on March 21, 1864, descriptive of researches specially undertaken to test the truth and importance of some of the very remarkable statements in Mr. John Taylor's altogether remarkable book, published in London in 1859, and entitled,— Origin of the Book.

The Great Pyramid; why was it built, and who built it?

They contain, therefore,—though without attempting to follow Mr. Taylor through the whole range of subject which his truly capacious mind and extensive reading had included,—the results of a not inconsiderable amount of investigation into original authorities on both the Pyramid and Egyptian monuments generally; as Endeavour to test the truth of Mr. Taylor's data and conclusions.

well, too, for the literature, as the mechanics, of the more scientific branches of the whole question which from their nature, were not very far removed from much of my professional experience.

From a right point of view the Pyramid question unfolds itself.

In the course of this proceeding I could hardly help both feeling and confessing, very much as Mr. Taylor had done before me, that the theory, meaning, and then even the very history of the Great Pyramid, open out almost spontaneously when viewed in connexion with right leading ideas. In many details I have arrived at the same results as Mr. Taylor, though by a different road; in others, by prosecuting them longer, I have been enabled to penetrate somewhat further; and in others again I may have a few slight differences from him, though the general and final result of the whole is eminently *with* him and his conclusions; both those of them bearing on the Great Pyramid, as being the most ancient of finished primeval monuments, and those also indicating the part which it has had already, and is intended still to perform, in organizing the metrology, or weights and measures, of many nations.

All of the more important of Mr. Taylor's conclusions affirmed, on examination by a second person.

Startling nature of some of the conclusions.

In this latter respect some of the conclusions are startling to a degree, especially as leading to a new and

ILLUSTRATIONS.

WOODCUTS.

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HELIOPOLIS
CAIRO
Babylon
MEMPHIS

PART I.

GEOGRAPHY AND THE EXTERIOR.

CHAPTER I.—INTRODUCTORY STATEMENT.

THE ancient Pyramids of Egypt form somewhat of a ng clustering group, extending chiefly over about a gree of latitude, and in nearly a central division of e country, as regards North and South, or the Lower d Upper, or more properly Middle, Egypt.

One traveller has noted forty-five, another ninety-e; no less than one hundred and thirty are also ntioned as existing in the neighbourhood of Meroe, ori, and Barkal in Ethiopia, though they ought, htfully, to be classed under a very different head; d there may be, altogether, many more pyramids still, various kinds, in one part or another of the long ley of the Nile. But when we extend the name to h large numbers, very inconsiderable, and often mparatively modern, structures are then included,

Pyramids numerous in Egypt.

wide variations allowed in form and materi
e more typical examples.

w it is precisely with these particular specimen
, the old examples of the country, and no other
t we have to do in this book; and selecting ev
rther amongst them, we find, that of all the mo
important instances that have yet attracted the atte
tion of mankind, there are none to equal the combin
fame and antiquity of the several stone pyramids n
Jizeh,[1] in view of the ancient Memphis, and not
from the present city of Cairo. They are situated on t
western, or more thoroughly African and desert, side
the river, and form a most remarkable and promin
group; planted apparently on the very edge of the d
and rocky steppe, and overlooking on one side the san
strewn wastes of the interior, and on the other t
green and fertile plains of Nile, about 130 feet belo
them. But amongst these Jizeh Pyramids, again, the
One of them more so than all the rest. is one that transcends in importance all the rest; o
that has been named for ages past "the Great Pyramid
and which stands out distinct and distinguished fr
all its fellows, by its giant size, its wondrous intern
structure, its superior and even exquisite finish, the de

[1] The following varieties of orthography, by different authors, may l
to the correct pronunciation, viz., Gyzeh, Ghizeh, Gizeh, Jeezeh, etc.

mysteries of its origin, and the hitherto in
destiny of its purpose.

With many of the smaller and later pyramids
is little doubt about their objects; for, built by
Egyptians as sepulchres for great Egyptian dead, s
lead were buried in them, and with all the writte
articulars, pictorial accompaniments, and strange sepul-
hral adornments of that too graphic religion, which
he fictile nation on the Nile ever delighted in. But as
e approach, ascending the stream of time, in a chrono-
gical survey to "the Great Pyramid," Egyptian em-
lems are gradually left behind; and in and throughout
at mighty builded mass, which all history and all
adition, both ancient and modern, agree in represent-
g as the first and earliest in point of date of the
hole Jizeh group,—we find in all its *finished* parts not
vestige of heathenism, nor the smallest indulgence
anything approaching to idolatry, not even the most
stant allusion to the sun or moon, or any of the starry
st of heaven.

Its anti-idolatrous character.

We have specified "finished parts," because in cer-
in unfinished portions of the masonry discovered by
olonel Howard-Vyse in 1837, there are some rude
rkings for a temporary purpose to be presently ex-
ined; and we also except, as a matter of course, any

ns inflicted on the Pyramid by modern travel-
ven though they have attempted to write their
s in the ancient hieroglyphics of the Egyptians,
with these simple exceptions we can most posi-
ely say, that both exterior and interior are indeed
bsolutely free from everything relating to idolatry in
art or man's device; and from all those hieratic emblems
which have utterly overlaid all Egyptian temples proper
all as well as all their obelisks, sphinxes, statues, tombs
and whatever other monuments they, the Egyptians
have erected at any historical epoch in connexion with
their peculiar, and, alas! degrading religion.

Was Great Pyramid prior to the Egyptian religion?

Was the Great Pyramid, then, erected before the
invention of hieroglyphics, and previous to the birth
of the Egyptian religion?

No! there history, tradition, and recent explorations
discoveries, testified to by many travellers and anti-
quaries, are perfectly in accord; and assure us that
the Egyptian nation was great, and its hieratic system
largely developed at the time of the erection of the Great
Pyramid; that that structure was even raised by the
labour of the Egyptian population;[1] but under some

[1] This very important conclusion results from the "Quarry marks" of the workmen—see Col. Howard-Vyse's volumes—being found on parts of the stones left rough, and in places not intended to be seen. The marks are evidently in the Egyptian language or manner freely handled; and

remarkable compulsion and constraint, which
them from putting their unmistakable and accu
marks on the finished building, and identifying it i
manner direct or indirect with their impure and Pa
form of worship.

According to Manetho, Herodotus, and other ancien
uthorities, the Egyptians hated, and yet implicitly
beyed the power that made them work on the Great
yramid; and when that power was again relaxed or
moved, though they still hated its name to such a

far prove that they were put in by Egyptians. They are excessively
le, no doubt; but quite sufficient as checks for workmen, whereby to
ognise a stone duly prepared at the quarry, and to see it placed in its
ended position in the building.

That they were not meant as ornaments in the building, or put on when
ere, is abundantly evident by some of them being upside down, and
me having been partly pared away in adjusting the stone into its posi-
on—(see Col. Howard-Vyse's plates of them)—and, finally, by the learned
r. Birch's interpretation of a number of the marks, which seem from
ence to be mostly dates, and directions to the workmen as to which
nes were for the south, and which for the north, wall.

Hieratic quarry-marks on the stones.

These markings are now only discoverable in those notable chambers of
nstruction opened by Col. Howard-Vyse above the "king's chamber"
the Great Pyramid. There also, you see the square holes in the stones,
which the heavy blocks were doubtless lifted to their places, and every-
ng is left perfectly rough; for these chambers were sealed up, or had
n built up in solid masonry, and were never intended to be used as
ambers for human visitation or human purposes. In all the other cham-
rs and passages, on the contrary, intended to be visited, the masonry is
ished off with the skill and polish of a jeweller; and neither quarry
rks nor "bat holes" nor hieroglyphics of any sort or kind are to be
n, excepting always those modern hieroglyphics which Dr. Lepsius in
43 put up over the entrance into the Great Pyramid, "on a space five
t in breadth by four feet in height," in praise of the then Sovereign of
ssia, the "King Cliquot" of many a number of *Punch*.

to forbear from even mentioning it,—yet with
itary bending to the sway of a superior intelli-
e, they took to imitating, for their own purposes,
w of the features of that great work on which they
l been employed so long; and began to adapt them
o far as they could be adapted, to their own favourit
ends and occupations.[1]

Hence the numerous *quasi*-copies, for *sepulchral* pu
poses, of the Great Pyramid, which are now to
observed along the banks of the Nile; though th
seem always to betray more or less ignorance of
principal internal features, and are never found at a
very great number of miles away from the site of
parent work. The architectural idea, indeed, thou
copied, yet never wholly took the fancy of the Egy
tians; it had some grand suitabilities to their favouri
employment of lasting sepulture, and the accompanyi
rites; so, with their inveterate taste for imitation, th
tried what they knew of it, for that purpose; but it

[1] Though the first of the Jizeh group, the Great Pyramid may h
been preceded by several other fabrics, of which the remains are to
seen at a distance of a few miles away; and indicate them to have b
at the best, but very imperfect embodiments of the true pyramidal id
if indeed they are not, in several features, actually antagonistic there
These will be duly considered in their place, and need not be referred
further here, as they do not seem to have locally retained either favou
prestige after the erection of the Great Pyramid, by far the most perf
as well as the largest, of all the Pyramids.

not admit of their troops of priests, nor the seas of abject worshippers, with the facility of their own temples, and so, on the whole, they preferred them. Those more open and columned, as well as statued structures, accordingly, of their own entire invention and elaboration, are the only ones which we now find to hold an uninterrupted reign, and to reflect themselves continuously in the placid stream of Nile, from one end of the long dawn land of Egypt to the other.

Pyramidal buildings not universal throughout Egypt.

Under whose direction, then, and for what purpose, was the Great Pyramid built, and under what sort of special compulsion was it, that the Egyptians laboured as a cause which they appreciated not, and gave their unrivalled mechanical skill for an end which they did not at the time understand, and which they never even came to understand in all subsequent ages?

Why, or by whom, was Great Pyramid built?

This is indeed a mystery of mysteries, but a noble one to inquire into. Theories without number have been tried, by ancient Greeks and mediæval Arabians, by Italians, French, English, Germans, and Americans; but the result has, up to the present time, been little more than this, that their authors are either found to be repeating idle tales told them by those who knew no more about the subject than themselves; or skipping the really crucial points of application for their

Attempts to solve the question.

theories which they should have attended to; or, finally, like some of the best and ablest men who have given themselves to the question, fairly admitting that they were entirely beaten.

Failure of all previous theories.

Hence the notion of temples to the sun and moo or for sacred fire, or holy water, or burial-places kings, or granaries for Joseph, or astronomical observ tories, or places of resort for mankind in a seco deluge, or of safety when the heavens should fall,—ha been for a long time past proved untenable; and t Great Pyramid stands out now, far more clearly than did in the time of Herodotus, as a prehistoric mon ment of an eminently grand and pure conception; a which, though in Egypt, is yet not of Egypt, and who true explanation is still to come.

A new idea produced by Mr. John Taylor.

Under these circumstances it is, that a new idea h been given to the world by Mr. John Taylor of Londo in a book published four years ago.[1] He has not himse visited the Pyramids, but has been for thirty years pa collecting and comparing all the published accounts those who have; and while so engaged, gradually a quite spontaneously, as he has described to me letter, the new theory opened out before him. It w assisted perhaps by the point of view from whence

[1] *The Great Pyramid, Why was it built?*

commenced his researches, and which is simply this: That whereas other writers have generally esteemed that those unknown and mysterious persons who directed the building of the Pyramid, and to whom the Egyptians gave abominable characters, must, therefore, have been very bad indeed; he, seeing how bad the Egyptians themselves were, thought, on the contrary, that those they hated (and could never sufficiently abuse) may perhaps have been very good, or, at all events, of a *different religious faith* from themselves; and then following up this idea by what the Bible itself records touching the most vital and distinguishing part of the Israelites' religion, and which is described some centuries after the building of the Pyramid as notoriously an "abomination to the Egyptians,"—Mr. Taylor deduces reasons for believing, that the directors of the building of the Great Pyramid were of the *chosen race,* and in the line of, though preceding Abraham; so early indeed as to be closer to Noah than to Abraham; and had been enabled by divine favour to appreciate the appointed idea, as to the necessity of a sacrifice for a sin-offering,—an idea co-eval with Abel and Cain, but which no man of Egyptian born would ever contemplate with a moment's patience.

His idea traced to a peculiar point of origin.

On this groundwork it is that Mr. Taylor takes his

Startling and important assertions by Mr. Taylor.

stand, and announces that he has discovered in the arrangements and measures of the Great Pyramid, as it now exists, certain scientific results, which speak of much more than, or rather something quite different from, human intelligence; for not only do the results rise above, and far above, the extremely limited and almost infantine knowledge of science possessed by any of the Gentile nations of 4300 years ago,—the period usually agreed on by most men for the foundation of that Pyramid,—but they are also, in whatever they apply to, very essentially above the extremely advanced state of scientific knowledge in our own time as well.

Necessity for examining them thoroughly.

This is indeed a bold assertion, but from its boldness capable of the completest refutation, if untrue; for the science of the present day compared with that of only a few hundred years ago, is capable of giving out no uncertain sound, both as to fact, and order, and time of discovery: much more then when applied to what little was known of it, in those more remote epochs, before physical science had begun to be seriously cultivated at all.

CHAPTER II.

GEOMETRICAL PROPORTIONS.

First Geometrical statement about the Great Pyramid.

MR. TAYLOR'S first proposition is, when slightly but immaterially altered to suit convenience of calculation, that the height of the Great Pyramid,—in its original condition, when every side was made into a perfect plane by means of the polished surface of the bevelled casing-stones; and when those sides, being continued up to their mutual intersections, terminated in a point, —that its height was, to twice its base, as the diameter to the circumference of a circle.

Or, as the case is represented in the following diagram (Fig. 1), where the square E F G H represents the base of the pyramid, and the shaded triangle, A B D, exhibits a vertical section of the pyramid through the middle of opposite sides:

Then,

A C, the vertical height of the pyramid, is to B D, the

side or breadth of its base, multiplied by 2, as the diameter to the circumference of a circle; or,

AC : DEFB : : 1 : circumference.

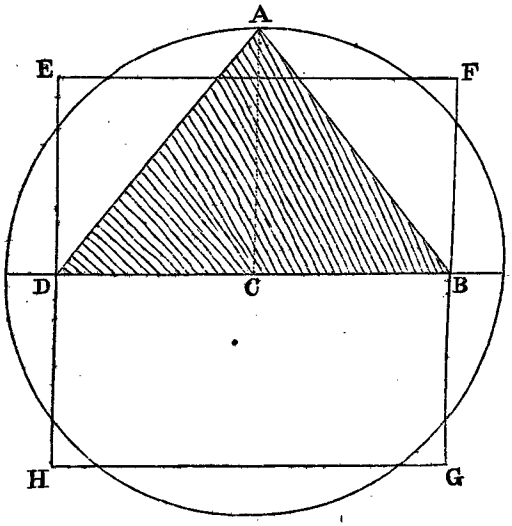


FIG. 1.

Result from Mr. Taylor's numbers.

As Mr. Taylor further states the vertical height of the pyramid to be 486 feet, and the breadth of its base 764 feet, we have

486 : 1528 : : 1 : 3·144.

Now, the true proportion of diameter to circumference being, as every one knows from pure mathematics

in the present day, 3·14159, etc., we see that th[redacted] numbers are correct, but the fourth is incorrect.

To have found, however, only three numbers built in correct into the primeval building, shows a striking achievement for that early time; seeing that one of the first of modern philosophers[1] has declared absolutely against the then Egyptians having had any approach to a calculus, by which they might have computed the proportion, even to a more moderate degree of exactitude.

Search for other data.

Let us inquire, however, what foundation Mr. Taylor may have, for the numbers that he has employed, being really those which the Pyramid was constructed to represent, or does contain within itself.

Extent of search.

In this research we have found it necessary to read rather extensively; the respective authors being not only numerous, but their accounts, as a rule, most strangely contradictory. Colonel Howard-Vyse, in the second volume of his important work published in 1840, gives either extracts, or abstracts made with admirable fairness, of no less than seventy-one European, and thirty-two Asiatic, authors. Several more are now to be added to the list, and it is extremely instructive to read them all. Unless, indeed, a very great number be read, no sufficient idea can be formed

[1] Sir John Herschel, *Athenæum*, April 23, 1860.

so how little faith is to be placed in the narratives even of educated men on a very simple matter; and when measures are given, which they report to have measured themselves, then ought we to feel most mistrust; unless, indeed, there are other means of proving that those often able scholars and learned philosophers did really understand what accurate measurement consists in.

Large probable errors in most printed accounts.

It would be easy to string together a series of so-called measures, made by successive travellers, on the same parts of the Great Pyramid, which should show its blocks of solid granite expanding and contracting between different visits like elastic india-rubber balls; but it will suffice for the present to indicate the necessity of weighing the evidence in every case most scrupulously; to have a large quantity of evidence, a great variety of observers, and to place in the first rank of authors to be studied in the original closely in every word they have written—

Standard authors on Great Pyramid.

Professor John Greaves in 1638;

The French Expedition in 1799;

Colonel Howard-Vyse in 1837; and

Sir Gardner Wilkinson from 1840 to 1858.

At present the Great Pyramid is externally a huge mass, rudely built of rough limestone blocks in steps,

and with a platform of considerable area on the top; but this has resulted from the removing of its polished marble casing, which had stood for more than 3000 years, and had given to the structure almost mathematical truth and perfection; as described by Greek, Roman, and early Arabian authors; until the Caliphs of Egypt, about the year 1000 A.D., began methodically to strip off the polished bevelled blocks, or portions of the Cyclopean glazing of the structure: built two bridges to convey them more easily to the river, and then employed them in building mosques and palaces; for the lining of the great "Joseph" well, and for other public structures which still adorn their favourite city El Káherah, or the Victorious—the Cairo of vulgar English. Ancient and modern appearance.

Since then, too, according to M. Jomard of the French Expedition, there is such an inveterate hankering in the minds of European tourists who climb to the top of the Pyramid, to detach some of the uppermost layers of stones, and send them thundering, crashing, and destroying down the side,—that the height of the Pyramid is daily decreasing, and the breadth of the platform at the top increasing. Degradation from mischief.

It is evidently then the original, not the present, size which we require, and must have, for testing Mr. Taylor's proposition; and he has well pointed out, that no

one had got to the true base until the French, in 1799, cleared away the hills of sand and debris at the north-east and north-west corners, and reached the levelled surface of the rock itself on which the Pyramid was originally founded. There, finding two hollows carefully, truly, and deeply cut into the rock, as if for "sockets" for the basal corner-stones, they measured the distance between them with all geodesic skill, and found it to be 232·747 metres, = 763·62 English feet. The same distance being made thirty-seven years afterwards by Colonel Howard-Vyse, guided by another equally sure direction of the original building, = 764·0 English feet, we may take, for the present problem, the mean, or 763·81 feet, as close enough for the base.

Good measures of base.

But the height of the Pyramid is not at all easy to measure directly, especially after so very much of the top has actually been knocked away, as to leave a platform "large enough for eleven camels to lie down," where once the four sides were continued up to a sharp point. In fact, the key-stone of the whole theory of the Pyramid would have been entirely wanting, even up to the present day, but for Colonel Howard-Vyse's most providential finding of two of the "casing stones" *in situ*. Up to that time, all ideas of the angle which the original side formed with the plane of the base, even

Height of Pyramid.

the very learned attempts of the French Academicians, were but guesses; and have turned out since to have been so far from the truth, as to be utterly incapable of maintaining the true geometrical analogy.

Remnant of the Casing-stones.

For ages it had been thought that the ruthless Caliphs had carried away every single casing-stone. But in their haste to make themselves rich by the supposed plunder of the interior of the pyramid, they had formed such a hill of debris at the place where they attempted to force their way in, that four of the valuable marble casing-stones were covered up. This they had apparently perceived some time after, and succeeded in extracting two of them by boring sideways through the hill of rubbish; but the other two remained either forgotten, or deemed impossible to reach, during 800 years, and until Colonel Howard-Vyse dug down to, and uncovered them, to the unspeakable intellectual benefit of the age in which we live.

Objections taken.

Since reading a paper on this subject at the Royal Society, Edinburgh, we have been informed that two very shrewd and experienced men have objected to this part of the statement. One of them, an engineer, says, "that he has passed through Egypt, been to the Pyramids, saw no symptoms of casing-stones, and therefore does not believe in them." The other, an Indian

naval officer, has also been to the Pyramids on a visit, and "found such huge heaps of rubbish about the Great one, that he cannot see how any man *could* measure the base correctly."

Both these speeches are only too faithful examples, of the small extent of information on which many persons will persist in speaking authoritatively on both the present, and long past, state of the Great Pyramid. The doubter about the casing-stones, should read first, the account of Herodotus, Strabo, Pliny, and many early Arabian authors when the casing was still complete, and eminently smooth and beautiful; and then Colonel Howard-Vyse's own book, descriptive both of how he succeeded in finding and measuring the two last of the blocks; and then how he failed, though he covered them up again with a mound of rubbish, to save them from the hammers of tourists and the axes of specimen-mongers. Besides which, the large amount of casing-stones still existing on other pyramids, as on the two large ones of Dashoor; the marble ones of the second Jizeh Pyramid, conspicuous near its summit, "with a polish shining resplendently afar," as says M. Jomard; and the granite ones of the third pyramid, so excessively hard that modern workmen have not cared to have much to do with them—should effect

Casing-stones, a normal feature in Pyramids.

much in convincing as to what was the original state of the Great Pyramid. While a similar case of spoliation to that, was perpetrated only a few years ago, on the south stone Pyramid of Dashoor by Defterdar Mohammed Bey, in order to procure marble blocks wherewith to build himself a palace near Cairo.

French discovery of ancient base of Pyramid.

Then the doubter about the possibility of other men succeeding in measuring what would have puzzled him,—should read the whole account of the French Academicians in Egypt, of which the following extract, from p. 63 of "*Antiquités Description*," vol. ii.,[1] is worthy of being more generally known, viz., that after digging down deep through the rubbish, "they recognised perfectly the esplanade upon which the pyramid had been established, and discovered happily at the north-east angle a large hollow socket (*encastrement*) worked in the rock, cut rectangularly and uninjured, where the corner-stone had been placed: it is an irregular square which is 3 metres broad in one direction, 3·52 metres

[1] "Ils reconnurent parfaitement l'esplanade sur laquelle a été établie la pyramide, et découvrirent heureusement à l'angle nord-est un large encastrement, creusé dans le roc, rectangulairement dressé et intact, où avait posé la pierre angulaire; c'est un carré irrégulier qui a 3 mètres dans un sens, 3·52 mètres dans l'autre, et de profondeur 0·207 mètre; ils firent les mêmes recherches à l'angle nord-ouest, et ils y retrouvèrent aussi un encastrement semblable au premier; tous deux étaient bien de niveau. C'est entre les deux points les plus extérieurs de ces enforcements et avec beaucoup de soins et de précautions qu'ils mesurèrent la base. Ils la trouvèrent de 232·747 mètres."

in another, and 0·207 of a metre deep. They made the same researches at the north-west angle, and there also discovered a hollow socket (*encastrement*) similar to the former: the two were on the same level. It was between the two exterior points of these hollows, and with much care and precaution, that they measured the base. They found it 232·747 metres."

French measure of base.

The "encastrement," so discovered in the basal rock at the north-east angle, is duly figured in plan amongst the large French plates, and has the inner corner curiously pared away, evidently indicating the outer corner as the true starting-point for measure; and from outer corner to outer corner of the north-east and the north-west "encastrements" it therefore was, that the skilful French surveyors extended their measuring lines.

Anomalies of early observers.

Mr. Taylor has assisted the discussion of errors of the better class of earlier observers, by imagining their having been really measuring along some of the steps or ranges of stones, at a height up the sides of the Pyramid; when, from the sand not having been cleared away, they erroneously thought they were at the bottom of the pile; and he seems to prove his case perfectly.

For the length of the real base of the Pyramid, therefore, no measure previous to the French one, can be depended on to within a good many feet, though the

measurers themselves might have noted what was before them pretty accurately; and the French measures cannot now be repeated, without first incurring a large cost in re-excavating the sites of those important "encastrements" or *fittings-in* of the lower corners of the Pyramid. Colonel Vyse, however, did go to this remarkable expense; and not only procured another measure of the very original Pyramid base itself from end to end; but, as already mentioned, found two of the casing-stones still forming, on the rocky platform, a firmly-cemented part of the old basal line of the Pyramid, and nearly mid-way between the two terminations.

Howard-Vyse supplements the French discovery.

The extreme and further value residing in these relics, was not only because they were of the number of the original casing-stones actually *in situ* and undisturbed, and therefore showing what was once the veritable outside of the Pyramid, viz., smooth polished marble in a sloping plane; but because they exhibited such matchless workmanship,—as correct and true it was as modern work by optical instrument-makers, but exhibited in this instance on stones of a height of near 5, a breadth of 8, and a length of 12 feet, with joints no thicker than "silver paper." The angle of the inclined or bevelled outer surface, measured very carefully by Mr. Brettell, civil engineer, for the Colonel, came out

Size and style of the discovered Casing-stones.

51° 50′; and being computed from linear measures of the sides, made for him by another engineer, came out 51° 52′ 15·5″;[1] results extremely accordant with one another, as compared with the French determination (before there was anything on which to determine, other than the present ruined and dilapidated sides of the edifice) of 51° 19′ 4″; or, of previous modern observers, who are found anywhere between 40° and 60°.

Angle of Casing-stones measured.

But the Colonel's engineers, though good men and true, were not accurate enough for the extraordinary accuracy and merits of the work they had to deal with; and in the *linear* measures which he gives in p. 261, vol. i., of his great work, (and the measures of the *sides* of a triangle, as every practical surveyor knows, are capable of laying down its particulars on paper much more accurately than can be done by using the angles through means of an angle-showing protractor,) there is one anomaly which seems to have escaped remark hitherto. The figure, a cross section, and its accompanying numbers, stand as in Fig. 2.

Sides measured.

The lengths, being only attempted to be given to the nearest inch, are lamentably short of the refinement to which they might have been taken; and an accurate measure of such noble sides, would have given the angle

[1] Sir John Herschel, *Athenæum*, April 23, 1860.

by calculation far closer than it could have been observed to, by any clinometer then at the pyramids, or indeed in all Egypt, and perhaps Europe.

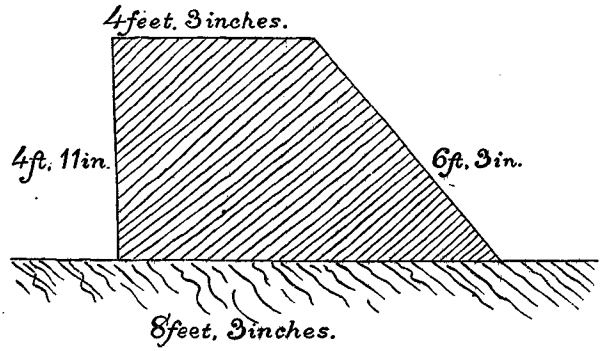


FIG. 2.

Calculation of sides.

By subtracting the upper, from the lower, surface, the figure is reduced to a triangle for calculation; and we have what should be a right-angled triangle at B (Fig. 3) where $a = 59$, $b = 75$, and $c = 48$ inches. But the value of the angle A is then found to be so very different, according as it is computed from b c, or a b, that we may soon perceive clearly that B is *not* a right angle; and on computing it from *the three sides*, it appears to be 88° 22′ 52·6″. This, however, is such an

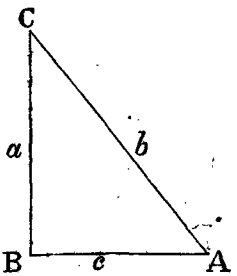


FIG. 3.

Anomaly in the measures.

egregious error for workmen like those of the Pyramid to have committed, and *in their easiest angle,* that we incline to think Mr. Perring must have made a mistake of an inch in his measure of the base of the stone, his most difficult side to measure. Indeed it would need a little more than an inch to be taken off his number, to bring the angle B up to 90°; but as Mr. Perring does not deal in smaller quantities than an inch, and as none of the sides were likely to have fallen on an even inch exactly, we have not ventured to make so strong a correction upon one only.

Probable conclusion from facts.

On the whole, taking everything into practical consideration, we have obtained three probable combinations of the computed angle at A, with Mr. Brettell's observed angle there; as thus,

51° 51′ 15·5″, 51° 51′ 5·4″, and 51° 51′ 22·0″,

of which three quantities the mean is 51° 51′ 14·3″.

Final angle, and Pyramid proportions.

Next employing this angle with the length of base = 763·81 to compute the height, we have for that = 486·2567; and from these new values of height and base, computing the proportion of diameter to circumference, there appears

486·2567 : 763·81 × 2 : : 1 : 3·14159, &c.,

which is far closer to the truth than anything which was found out by men mathematically for ages after

the building of the Pyramid; and from anything which we had a right to expect, from the wideness of errors among the best modern observations made upon the stones themselves, whether addressed to their angles or their sides. Closeness of Pyramid result.

Modern theoretical science no doubt both can compute, and actually has computed, the proportion to a far greater degree of closeness, to 300 places of decimals for instance; but modern science is unfortunately very unequal. Some theoretical points are pursued to an excessive extent past all visible use, while the application of others to nature and art is left in a sadly crude condition; and with regard to realizing the proportion now spoken of in a building, the moderns have never reached anything at all equal to the accuracy of the Great Pyramid. As compared with modern practical work.

Perhaps it may be answered that the moderns have never tried so to do; and we may allow them that they have not; but they have attempted at the Pyramid, over and over again, to measure the performances of those who have; and it is an acknowledged practical truth in every existing astronomical Observatory, that it is far easier to measure the state, and approximate to the error of any mechanical arrangement, than to make that state mechanically perfect.

In their measurements, therefore, of the Pyramid, the moderns have had an advantage over the primeval builders of it; and how have they come off in the trial? Why, it has been shown that the exactness of the Pyramid has improved under every advance of exactness in the measures applied to it; and whether the differences of modern measures, in their first stage of coarseness, differed from each other by several degrees, or subsequently by several minutes, and latterly by a few seconds only, the Pyramid itself was ever found in the mean position amongst them; like the bull's-eye in the centre of a target, though the bullet-holes of bad shooters might be found more frequently at all points of its circumference; and whose marks, therefore, seen by themselves, would give subsequent visitors exceeding trouble in concluding precisely what the marksmen had been firing at.

Pyramid result improves with severity of examination.

Hence the first stage of our trial terminates itself with as eminent a confirmation, as the case can possibly admit of, touching the truth of Mr. Taylor's proposition or statement; and adds intrinsic weight to the notable corollary which he deduces from it.

Mr. Taylor's first proposition fully supported.

CHAPTER III.

STANDARD OF LENGTH EMPLOYED IN THE GREAT PYRAMID.

IN the process of computing the exact circumferential analogy on p. 24, we arrived at improved statements of the absolute linear height, and length of side of base of the Great Pyramid,[1] and these quantities were expressed in English feet; but it does not therefore follow that they, or indeed any foot-measures, were employed by the ancient builders.

Modern measures of Pyramid expressed in feet.

Certainly the length, complication, and inconvenience of the fractions obliged to be introduced, in order to represent the true proportions of the one Pyramid element to the other, in such terms, forbid the idea. No doubt, that a foot is something of a natural measure, and may have been extensively used in Egypt and through the East in many agricultural and other operations, which, if lowly, "are innocent and hurt not;"

[1] Viz. vertical height = 486·2566, &c., feet, and length of one side of base = 763·81 feet.

but still we think there is good reason for disputing, whether a "foot" was ever lifted up against that grandest building of antiquity, the Great Pyramid, by the authors thereof.

What were likely to have been the terms of the ancient measures.

If then a foot-measure was not likely, what sort of measure *was* likely, to have been employed there?

As a first step in such an inquiry, let us see whether an equally exact proportion between height and twice-base, to what our long fractions of feet gave, cannot be obtained from some simpler numbers. After many trials we have selected,

$$116{\cdot}5 : 366{\cdot}0.$$

A probable term.

These are not exact, as no simple numbers can be, when the proportion itself belongs really to the incommensurables; but it is an astonishingly close approach for such plain and small numbers to make; and the exceedingly small fraction[1] by which the one should be increased, or the other decreased, does not, in the existing state of our knowledge, make any practical difference upon any of the questions which we shall have presently to take up.

Are there, however, any other reasons why we should adopt those particular numbers?

[1] 116·5014 : 366·0000, or
116·5000 : 365·9956, would be closer.

There are so.

First support of probability.

In the first place, 366, which represents here the circumferential analogy of a circle (and what circle so notable to man as the circle of a year), is also the nearest *even* number of days in a year. We now know that the exact quantity is 365·24221 ; but 366 is vastly closer than the 300, or 360, with which divers ancient priests were afterwards trying to make their theories suit the recurrence of the seasons.

It is also the number of days in one of our practical years—of leap-year; and further, it is the very number that we ourselves would adopt in any mechanical case, where the measure of the year was one, but not the first, and only, problem to be accomplished.

We are all the bolder in making this assertion, because the fact actually occurred, and in a perfectly independent manner, only last year in the University of Edinburgh.[1]

In the second place it may be stated, that that por-

[1] The case was this. At the lighting of the College Library for the Conversazione given to the Social Science Association, it was proposed to increase the two rows of 360 gas-burners each, to such a number as should typify the days in the year; and the method set forth was, to have 366 burners on either side, but to have the flame coming sideways instead of vertically out of the 366th: so as to remind the beholder, or set him thinking, that there was something the matter with that 366th burner: indicating, perhaps, that there might be concealed there a fraction for his mind, rather than his eye, to take into contemplation.

Second support of probability.

tion of the Pyramid employed in the problem under discussion, when it comes to be divided into 366 parts, gives each of them a length equal to $\frac{1}{10 \text{ millionth}}$ of the earth's axis of rotation!

More than wonderful, if true.

This is a feature, in all sober truth, of the most extraordinary importance. It is only since Newton's time that men have attributed anything peculiar in its size to the earth's axis of rotation; and every modern civilized nation has, during the present century, been obliged to perform gigantic trigonometrical operations, and "degree measurings," in order to arrive at any exact knowledge of the true length. Their various results oscillate about 500,500,000 English inches, or, as Sir John Herschel[1] thinks, 500,495,000; but some of them, even the best modern ones, profiting by our long Indian arc for low, and the immense Russian arc for high, latitudes, are as great as 500,560,000, and others as small as 500,378,000. Such are the limits of uncertainty in which England, France, Germany, and Russia are placed at the present moment; and yet they are immensely closer in accord, and nearer to the truth, than they were only fifty years ago, and have performed their difficult parts right well for men.

We wish that as much skill and accuracy had been

[1] *Athenæum*, April 1860.

expended on the measures of the Great Pyramid. There, our two best observations, already quoted—the French one and Colonel Howard-Vyse's—differ by 0·4 of a foot on a length of 764 feet only.[1] Examination of the truth of the case.

The French measure looks the more accurately attempted of the two, and gives for the 366th part in inches of the circumferential representative of the Great Pyramid (*i. e.*, twice its base) multiplied into 10 millions, = 500,734,000; or if we defer to the 366th division having a remainder of incommensurability about it, and take 365·9956 instead, the quantity becomes = 500,740,500. French and English results compared

But the English measure by Howard-Vyse and Perring,[2] similarly tested, yields 500,990,000. There are reasons, however, for considering their measure not only rude, as it evidently is from the small refinement that they go to in subdivisions, but erroneous also, in having too short a standard scale, and therefore putting too many inches into every measure they made.

In fact, if we compare their measures of the interior of the "Porphyry Coffer" (see further on, Part II.), which

[1] Sir Thomas Maclear's base-line in Zwartland Plain, at the Cape of Good Hope, showed a probable error, by two different modes, of about 0·25 of an inch on 8 miles.

[2] Their measure of the length of the original base was given by them at 764 feet even. $\frac{764\times 12\times 2}{366}\times 10{,}000{,}000 = 500{,}984{,}000$.

ought to have been their most accurate possible, with those of Professor John Greaves, we find as follows:—

	Howard-Vyse and Perring.	Greaves.
	Inches.	Inches.
Length, . .	78·0	77·856
Breadth, . .	26·5	26·616
Depth, . .	34·5	34·320
	139·000	138·792

Errors of Howard-Vyse's scale, investigated.

But inasmuch as Greaves' observations are said to labour under a similar fault (though by an early writer in the *Philosophical Transactions*, who may be just as much in error), and to require 0·002 in. to be subtracted from every inch, it would result from this that Howard-Vyse and Perring's measures should be multiplied by 0·99651, to make them give true British inches. This correction, duly applied, causes their Pyramid measure to give for the earth, only 499,242,000. This, however, appears in our eyes to be depending too much on the assertions of Greaves' correctors;[1] and we shall be safer

[1] Since this was written, we have alighted in the *Description de l'Egypte*, on M. Jomard's determination of the length of Greaves' foot measure, which he has made not so erroneous as even Greaves himself had imagined; and in fact on reducing Jomard's result of 0·30460 metre to English inches, on the understanding of 1 metre being equal to 39·37079 English inches, it appears that 1 foot of Greaves' "radius of 10 feet neatly divided into 10,000 parts," are = 11·992 modern English inches. Correcting Greaves in this proportion, and then Howard-Vyse and Perring on Greaves, their measures give 499,915,000, or 499,921,000 for the quantity which we are in search of.

if we take a mean between the entirely uncorrected, and the probably over-corrected, measure of Howard-Vyse and Perring, which gives 500,116,000. We then have a quantity, which, when combined with the deduction from the French measure, gives so nearly the same result as the mean of all the modern measures of the earth's axis of rotation, that we can hardly but allow the two to have been equally intended for the same thing, viz., the Polar axis of the earth. Set side by side, in a manner to show the errors of observation in either case, we have,—

Mean conclusions for errors of scales.

From Earth's Measure.	From Pyramid's Measure.
500,560,000	500,990,000
500,560,000	[2] 500,740,500
500,495,000	500,740,500
500,495,000	500,740,500
[1] 500,378,000	499,242,000
500,497,600 ,	500,490,700 ;

Mean results for Earth, from measure, and from Pyramid.

the equatorial axis of the earth being at the same time somewhere between 502,000,000, and 503,000,000 English inches.

[1] Only half the weight of the others is given to this last observation, agreeably with the opinion expressed of its merits by General de Schubert, Sir J. Herschel, and others.

[2] The French measure is repeated three times, so as to have a share, in the proportion of three to two in the mean, with the English; having been previously pronounced the more carefully executed measure of the two.

Ancient Pyramid standard, thence concluded.

Taking then the earth's polar axis to be really equal to 500,495,000 English inches, *i.e.*, continuing to show more respect to Sir J. Herschel's conclusion than our own, and our Pyramid proportion to come practically to the same thing—then, each of the lengths, of which 366 were used in a remarkable manner in laying out the base of the Pyramid, are equal to 50·0495 English inches. That was in fact the standard measure of the Pyramid 4300 years ago, and was without doubt then divided into 50 inches evenly; for we learn from other sources that inches were used, that fractions were eliminated as much as possible, and that much importance was attached to the number 5; the Pyramid itself being a five-angled, and, with its basal plane, a five-sided solid, in which everything went by fives or numbers of five, and powers of five.

Standards, and units, abstractly.

Let it be clearly understood, however, that there is a radical difference between a "standard measure," and a "unit of measure;" for a "standard" may be any number of the *units*, strung in a manner temporarily together to make a convenient whole-length, suitable for some particular subject of human employment or research. That whole-length of course is, or should be, exactly the same length, as if we took the prescribed number of the units separately, at the time; but

then it is arrived at, in practice, by using the standard already constructed, much more quickly ; and much more correctly too, for there is always a source of error in applying hastily one material separate measure to another.

Illustration from English practice.

Hence, when the Royal Astronomical Society of London, under the leadership of Mr. Baily, were preparing the new British standards for Government after the burning of the ancient ones in the fire of the Houses of Parliament, they adopted a greater length than before, viz. 5 feet in place of 3, for the standard; though the unit of length they intended to remain precisely what it was before, even to the $\frac{1}{10,000}$th of an inch.

Standards therefore may vary much, and they have varied in our country from 1 foot to 3 feet, 5 feet, 6 feet, and 10 feet, according to what was required of them at the time; but at the Pyramid, it would appear, not that the standards were varied from time to time, but that there were several in use for different purposes, all of them however bearing a fixed relation to the *unit* of linear measure, and being some convenient multiple thereof.

The *unit* of all linear measure at the Pyramid.

Thus the unit, an indefeasible and unalterable quantity, was, 1 inch = $\frac{1}{500,000,000}$th of earth's axis of rotation.

Grand standard.

Fifty of these units strung together, made the "Grand standard" for all the most difficult and scientific ques-

tions, and was therefore $= \frac{1}{10,000,000}$th of the earth's axis of rotation.

But as that was an inconveniently large quantity or length of staff to be dealing with indoors, and on all ordinary occasions,—the half of it, or 25 inches, seems to have been held as a "Small standard," and then amounted to $\frac{1}{20,000,000}$th of the earth's axis of rotation.

Small standard.

Again, to suit the plodding purposes of mechanic men employed in tilling the soil, something smaller still, and suitable to what they trod on, was required; and then, twelve of the units were strung together, to make a standard *foot*. The *unit inch* was still preserved accurately; but the *standard's* scientific connexion in an even fraction with the earth's axis of rotation, or its numerical alliance with the arithmetical relations of the Pyramid, was gone.

Tolerated foot-standard.

Now, all these standards we have it in our power to restore at once; for the ancient Pyramid unit, the inch, being, as before stated $= \frac{1}{500,000,000}$th of the earth's axis of rotation, and that length being, within the limits of errors of the best modern observation, = 500,495,000 English inches,—plainly

English lengths of the Pyramid linear standards.

1 ancient *Unit* Pyramid inch = 1·00099 English inches.
1 ancient "Grand Standard" = 50 Pyramid in. = 50·04950 Eng. in.
1 ancient "Small Standard" = 25 Pyramid in. = 25·02475 Eng. in.
1 ancient Pyramid foot = 12 Pyramid in. = 12·0119 Eng. inches.

We have thus arrived by an independent inquiry of our own, at a result which Mr. Taylor obtains by a different and somewhat less direct process; and what a result it is, in whatever point of view we look upon it, or by whatever road we have attained to it!

Mr. Taylor's statements again supported.

The nations of the world 3000 years ago, of their own selves and by their own knowledge, cared little about their national measures, and knew nothing, but what was childish with regard to the size of the earth; so that all our present exact acquaintance with it, is confined within the history of the last hundred years. The great attempt of the French people to abolish alike the Christian religion, and the hereditary weights and measures of all nations; and to replace the former by a worship of philosophy, and the latter by a scheme depending on one feature in the magnitude of the earth, as well as to substitute the week of seven days, by an artificial period of ten days,—is only seventy years old. And how did they, the French philosophers, endeavour to carry out the metrological part of their scheme? By assuming as their unit of length, the $\frac{1}{10,000,000}$th of a "quadrant of the earth's *surface*!"

Importance of result.

Well may we ask if that was all that science, trusting in itself, was able to do for them. For the grasp and understanding of the subject, that took a portion of the

earth's surface, in place of the axis of rotation, was truly inferior in the extreme. As Sir John Herschel has well said, but only *after* Mr. Taylor's statement about the Pyramid had lighted up his mind with the exquisite thought, of how near after all the British hereditary inch is to an integral earth-measure, and the best earth-measure that he had ever heard of,—so long as the human mind continues to be human, and retain a power of geometry, so long will the diameter, be thought of more primary importance than the circumference, of a circle; and when we come to a sphere, and in motion, the axis of its dynamical labour should hold a vastly superior importance still.

Sir John Herschel's confirmation, of importance of Mr. Taylor's discovery.

Again, the French philosophers of seventy years ago, in fixing on a quadrant of *surface*, had no idea that within the last three years the progress of geodesy would have shown that the earth's equator is not a circle, but a rather irregular curvilinear triangle,[1] so that it has many different equatorial axes, and therefore also *different* lengths of quadrants in different longitudes. *They*, the *savants* of Paris, could not indeed foresee these things of the present day, or a state of geodesic science beyond them; and yet these things

Blindness of the French metrology.

[1] See M. de Schubert in *Transactions of Imp. Acad. of St. Petersburg*, and G. B. Airy, Astr. R., in *Monthly Notices of Royal Astron. Soc.*

were all taken into account by the Mind that directed the building of the Great Pyramid 4300 years ago; and the reference for the unit then adopted, is now shown to be the only really scientific one which the earth possesses. Through those long mediæval periods, too, of darkness and confusion and war, when our nation thought of no such things, the same Master-mind likewise prevented our *hereditary unit of measure*, the inch, from losing more than the thousandth-part of itself by the friction of ages; for this is the result, if it turns out, as Mr. Taylor believes—and as he was the first of men in these latter days both to believe and to publish his belief—that the Great Pyramid is the one necessarily-material centre from which those material things, weights and measures, in a primeval age, somewhere between the time of Noah and Abraham, take whatever chronology you will, were Divinely distributed to every leading people and tongue.

Pyramid unit, and English hereditary unit, of measure, *the inch*, strangely alike.

CHAPTER IV.

FIGURE OF THE EARTH.

THE results just arrived at, from our connexion of the double base of the Pyramid with the earth's axis of rotation, are, as already intimated, very similar to those which Mr. Taylor obtained by pursuing his own mode of inquiry.

Mr. Taylor's two size-analogies.

But it will be worth while to bestow some special attention on two of the analogies which he discovered; and which, on being examined soon after by Sir John Herschel,[1] were declared by him to be, so far as he knew, the only relations between the size of the earth and the size of the Pyramid which had up to then been made out; though at the same time he expressed his belief that they were only approximate.

Let us, however, test them over again, and by the analogy which we ourselves have obtained; for inasmuch as that allows us to speak of the Pyramid in the

[1] *Athenæum*, April 1860; and Mr. Taylor's *Battle of the Standards*, 1864.

primal measures employed by its builders, we may thereby be enabled to put their work to a stricter test.

We will accept, then, as before, the old or primal unit of measure, viz. an inch, each one being the $\frac{1}{500,000,000}$th of the earth's axis of rotation; and the "grand standard," a primal *metron* of fifty such inches; of which metrons, 116·5 measure the height, and 183 the side of the base, of the Pyramid; and as this, the base, is at the foot of the Pyramid, we will give it in feet also, of twelve such primal inches to the foot. Preparations for examining them.

Then in the triangle, A B C D—

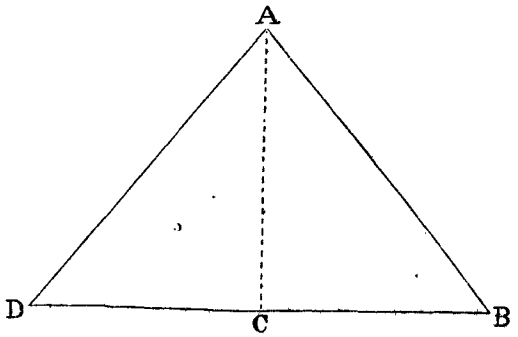


FIG. 4.

A C = 116·5 primal metrons, =
5825·0 primal or Pyramid inches.
And B D = 183·0 primal metrons, =
9150·0 primal or Pyramid inches, =
762·5 primal or Pyramid feet.

Pyramid dimensions in ancient terms.

The first of Mr. Taylor's two size-analogies is, when put into the form subsequently chosen by Sir John Herschel, "a band encircling the earth, of the breadth of the base of the Great Pyramid, contains one hundred thousand million square feet."

Adapting this statement to our primal feet, and to a form suitable to bring out the diameter rather than the circumference, and in inches, we have for such a diameter:—

Result of first, or "breadth," analogy.

$$\frac{100{,}000{,}000{,}000}{\frac{762{\cdot}5}{12} \times 3{\cdot}14159, \text{ etc.}} = 500{,}946{,}700 \text{ primal or Pyramid inches.}$$

Noting only that this is a very different quantity from the *rotation* axis in primal inches, we proceed to Mr. Taylor's second analogy; or, that "the height of the Pyramid is, $\frac{1}{270{,}000}$th of the earth's circumference."

Second, or "height," analogy.

Before submitting this statement to computation, we felt inclined to inquire, why 270,000: for it is not a very round number, and has no apparent connexion, by *fives* or in any other way, with the Pyramid?

Finding, however, that the area of the base of the Pyramid in hundredths of feet has, when thrown into a circular shape, a circumference equal to 270,299, we presumed that that might be accepted as a reason; and

then, trying the case in a form to bring out the axis in inches, obtained—

$$\text{Height of pyramid in inches, } \times \frac{270{,}299}{3{\cdot}14159} = x, \text{ or}$$

Its result.

$$5825{\cdot}0 \times 86038{\cdot}901 = 501{,}176{,}400 \text{ primal inches.}$$

Here is a quantity, then, very different again from the last and from the Polar. But if any special result be given by the height of the Pyramid itself, what is so likely to have been intended as the terrestrial diameter in its (the Pyramid's) own latitude, or 29° 59′ 6″ N.;[1] and, in the former case, when a band enveloping the earth is given, what so likely to be typified there, as the latitude of 45°? To test this idea, we have computed according to the usual formula, with a compression of $\frac{1}{300}$, the favourite quantity in the present day, the diameter of the earth in different parallels assuming

On the meaning of the two size-analogies.

[1] This determination is taken from the map of the great French work on Egypt. In the letterpress of the Memoir, p. 62, it is given 28° 52′ 2″, and the longitude is called 29° 59′ 6″; but this must surely be a mistake. Yet it is a class of mistake sadly frequent in Pyramid literature. Thus, in the same work (and that work has been declared, over and over again, by French and Americans, to be the most immortal conception and glorious performance of a book ever realized by man), M. Jomard wonders, at p. 198, in the grandest of language, and with very good philosophy, too, creditable alike to his heart and his head, at what can be the meaning of those 25 remarkable holes in the ramps of the great gallery; and at p. 206, he again wonders at them, but makes them 28! I have searched, therefore, through other authors, and have got two testimonies to the holes being 28 on either side; and two to there being 28 on one side, and 26 on the other.

Pyramid's Latitude.

its Polar diameter = 500,000,000; and placed the three Pyramid analogies by the side of them, thus—

Computed Earth Diameters.		Pyramid Analogies.	
Polar	= 500,000,000	Polar	= 500,000,000
Lat. 60°	= 500,420,000	Lat. 60°	=
Lat. 45°	= 500,840,000	Lat. 45°	= 500,946,700
Lat. 30°	= 501,257,000	Lat. 30°	= 501,176,400
Equator	= 501,672,000	Equator	=

Pyramid analogies, indicate Polar compression of Earth.

From the close approach to agreement here manifested, there can hardly be any doubt but that the differences between the several parts of the Pyramid were intended: and we then have a spectacle never seen in the world before, or since, of a standard measure which indicates the *shape*, as well as the *size*, of the earth; or which, if it has had chosen for it one particular axis to form the unit upon, and the best axis or diameter for that purpose, though the least of all, does not leave us under any false ideas as to the true size of the entire world on which we live.

Mean compression, $= \frac{1}{300}$.

While, however, the great majority of what seemed at first to be most anomalous excesses at the supposed 45° and 30° of Mr. Taylor's two size-analogies, is undoubtedly capable of being cleared away by reference to a compression of $\frac{1}{300}$,—there is a small residual quantity on each which cannot be so removed, for it is in excess at one, and defect at the other. We have got

then herein to the full extent, as far as the mere mathematical idea of a regular ellipsoidal figure of a certain amount of compression for the earth will help us; $\frac{9}{10}$ths of the whole anomaly are explained, but $\frac{1}{10}$th remains; and that is too small a quantity for the geodesists themselves to be certain of in their measures.

Residual anomalies.

What shall we venture to say then? Is the Pyramid argument to a small extent erroneous after all; or, is the earth itself perhaps *not* of a regular mathematical figure in the direction of a meridian, over and above of course the other irregularities of shape, depending on, or following, the law of the longitude?

Scientific doubts.

We cannot pretend to any positive opinion on this case, for herein have we reached the farthest advance of geodesic science: but this we may be at liberty to mention, that the possibility of a deviation from an ellipsoidal figure in a meridional direction has already occurred, as a necessity impending over them before long to admit, amongst a number of the more advanced geodesists of the present day.

They find, as they say, that after exhausting all the refinements of calculation, they cannot get separate pairs of well-measured arcs in different latitudes to coincide in giving the same constant amount of terrestrial compression, within the limits which they appa-

rently should do; and would, if the arcs were really and truly well measured, and the earth was veritably shaped into a pure ellipsoid-of-revolution figure.[1]

A section of the earth, therefore, through a meridian plane, would not, it is beginning now to be suspected in learned societies, exhibit a regular elliptical curvature at the edges. In what direction the deviation, upon a deviation from the most simple mathematical figure, would show itself, in such a case, there must be many doubts; and they can only be fully answered by the measurement of more arcs of the meridian, with greater care than ever. But in the meantime there is no harm in stating, that according to the present mode of interpretation, the Great Pyramid analogies do indicate such an irregularity to exist: and they make it occur in the same *direction*, as that famous, though disputed, irregularity of figure, believed to have been detected in the planet Saturn, by Sir William Herschel; viz. something of a protrusion at 45°, and a sinking in at 25°, or rather a certain squareness of form, with the angles protruding in the latitude-parallels of 45°.

Residual anomalies at Pyramid, agree with suspected anomalies in figure of Earth.

[1] Even these minuter portions of the earth's protrusions due to figure of the whole, are quite distinct from the inequalities of mountain and valley, which are considered separately and by themselves in such an inquiry.

CHAPTER V.

LATITUDE INDICATIONS IN THE PYRAMID.

IT may, however, be demanded by very earnest inquirers, to be shown some solid and material proofs of the special latitudes 45° and 30°, having been intended by the primeval builders of the Pyramid, before they fully admit an entirely non-accidental character in the remarkable numerical statements which have just been given.

Difficulties in the modern inquiry.

Had the Pyramid been handed down to us with its outer casing and the original inscriptions thereon[1] uninjured by man, there is little doubt but that this most reasonable desire would have found its complete satisfaction. There is still enough, however, in the few ruined remains of the Pyramid, to answer even critical inquirers in this case, where it is plain that the latitude can only be very *approximately* required.

[1] The interpretation attempted or pretended to be given to Herodotus by an Egyptian priest, was too plainly beyond that Egyptian's power to give.—See Mr. Taylor's *Great Pyramid*, etc., p. 277.

To begin, we may remind, that the square base of the Great Pyramid is very truly oriented, or placed with its sides facing due north, south, east, and west; and this fact at once abolishes all theories to the effect, that the forms and positions of component parts of the Pyramid, depend on pure geometry alone; for, to pure geometry, all azimuths are alike. The practical science of astronomy must therefore have been appealed to, for picking out one particular azimuth, out of an infinite number of possible ones; and gives us reason for believing, that if, in the same place and same building, we do succeed in stumbling on any decided allusion to a vertical angle of 30° or 45°, it will have been intended to bear an astronomical application.

Astronomy consulted in the placing of Pyramid.

In the early ages of the world, the very correct orientation of a large pile, must have been extremely difficult to the rude astronomy of the period. Yet with such precision had the operations been performed on the Great Pyramid, that the French Academicians in A.D. 1799 were not a little astonished at the closeness. Their citizen astronomer Nouet "in the month Nivose of *their* year 7," made refined observations to test the error, and found it to be only 19′ 58″; but with the qualification added by M. Jomard, that as he only had the ruined exterior of the Pyramid before him to test—

Tested by the French.

the real error of the original finished surface might have been less. In this he was doubtless right; for in the similar sort of measure of the angle of the side, with the base of the Pyramid, it was proved afterwards, on the discovery of the casing-stones, that his compatriot had erred to a very much larger extent than the original builders.

French surprised at Pyramid's truth.

As it was, however, M. Jomard and the authors of the great Napoleonic compilation, were delighted with the proof which the Pyramid seemed to give them, when compared with their own modern French observations of stars,—"that the azimuthal direction of the earth's axis had not sensibly altered, relatively to the sides of the Pyramid's base, during something like 5000 years."

Bearings of the question on Geography.

Now this has long been a mooted question among astronomers, though chiefly for its bearing on geography and geology; and in its nature, it must be kept entirely distinct from the more perfectly astronomical phenomenon, and which few but astronomers care at all about, viz., the direction of the earth's axis *in space;* and wherein the precession of the equinoxes comes to act. But in the light in which it was discussed by the French *savants* of the Revolution, it had also been clearly seen long before by the penetrating genius of Dr. Hooke;

Dr. Hooke on possible changes in terrestrial latitudes.

who, in his discourse on Earthquakes, about the year 1677 A.D., remarks, "Whether the axis of the earth's rotation hath and doth continually by a slow progression vary its position, with respect to the parts of the earth; and if so, how much, and which way, which must vary both the meridian lines of places, and also their particular latitudes? that it had been very desirable, if from some monuments or records in antiquity, somewhat could have been discovered of certainty and exactness, that by comparing that or them with accurate observations now made or to be made, somewhat of certainty of information could have been procured;" and he proceeds thus: "But I fear we shall find them all insufficient in accurateness to be any ways relied upon; however, if there can be found anything certain and accurately done, either as to the fixing of a meridian line on some building or structure now in being, or to the positive or certain latitude of any known place, though possibly these observations or constructions were made without any regard or notion of such an hypothesis; yet some of them, compared with the present state of things, might give much light to this inquiry. Upon this account I perused Mr. Greaves' description of the GREAT PYRAMID IN EGYPT that being fabled to have been built for an astronomical Observa-

tory, as Mr. Greaves also takes notice. I perused his book, I say, hoping I should have found, among many other curious observations he there gives us concerning them, some observations perfectly made, to find whether it stands east, west, north, and south, or whether it varies from that respect of its sides to any other part or quarter of the world; as likewise how much, and which way they now stand. But to my wonder, he being an astronomical professor, I do not find that he had any regard at all to the same, but seems to be wholly taken up with one inquiry, which was about the measure or bigness of the whole and its parts; and the other matters mentioned are only by the bye and accidental, which shows how useful theories may be for the future to such as shall make observations."

Dr. Hooke on Professor Greaves.

Dr. Hooke, however, in mitigation of whose acerbity there is much to be said in excuse, for Nature made him, so his biographer asserts, "short of stature, thin, and crooked;" this real phenomenon Dr. Hooke, "who seldom retired to bed till two or three o'clock in the morning, and frequently pursued his studies during the whole night,"—would not have been so hard upon his predecessor in difficult times, if he had known, and as we may by and by be able to set forth, what extraordinarily useful work it was, that Professor Greaves

Dr. Hooke's character.

zealously engaged in when at the Pyramid. The Doctor's diatribes should rather have been at his successors-to-be, those who were to visit the Pyramid in easy times, and then and there do nothing, or mere mischief, worse than nothing. Whence it remains still, to any good and enterprising traveller, to determine with full modern accuracy the astronomical azimuth of the Pyramid, both upon its fiducial socket marks; and, still more importantly, on its internal passages.

Azimuthal observations desired.

These passages are worthy of all attention; and a further proof of the importance attached by the primeval builders to the strict "orientation" of the whole building, in each of its parts as well as its mass, is eminently shown by the perfectly parallel position which they preserved for the azimuth of the first, or entering passage; and this, too, notwithstanding that (as Sir Gardner Wilkinson explains), there were structural, or rather deeply politic, reasons for their not placing that said aperture exactly in the middle of the northern side in which it is found, but a considerable number of feet nearer towards the east than the west.

Parallel position of entrance passage.

This peculiar eccentric position, but preservation of parallelism and meridian direction, for the internal passages of the Great Pyramid, is indicated by the plan which is inserted in Plate III. Fig 1.

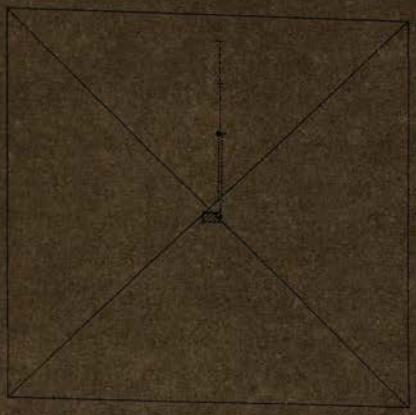
Plan in Plate III. Fig. 1.

GREAT PYRAMID.
IN PLAN.

PLATE 3

FIG. 1

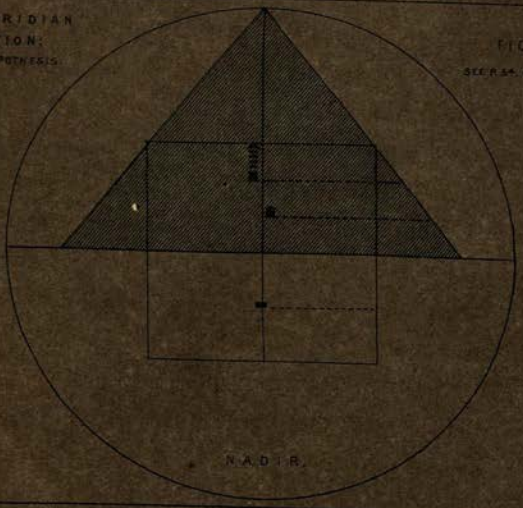
SEE P. 82. CH. 5. PART II.



IN MERIDIAN
SECTION:
WITH HYPOTHESIS.

FIG. 2

SEE P. 84. CH. 5. PART II.



The Pyramid is there shown in transparent plan, and the dotted lines indicate the whole amount, in so far as they can appear in a plan, of passages, chambers, and hollow work of every kind, in the huge mass of firm masonry; where evidently there was a marked preference given to astronomical truth, over mechanical symmetry or social convenience.

Azimuth fixations by the "Magnet."

In page 26 of George R. Gliddon's *Otia Ægyptiaca*, its acute author does indeed suggest, that all this exactness of orientation indicates, amongst the builders of the "pre-antiquity" day of the Pyramid, "an acquaintance with the laws of the Magnet;" yet had that been all the founders were possessed of to guide them, their great and lasting work might have been in error by as much as twenty degrees, in place of only twenty minutes, or perhaps as many seconds.

Discussed.

George R. Gliddon is truly, on most topics, a particularly well-read man, and has nearly a lifetime of Egyptian experience to dilate on, as he does, too, with an eloquence rarely surpassed by any one; but, unfortunately, he shares the belief of a large part of the world, that more wisdom and science are manifested if you do a thing badly and imperfectly by the indications of magnetism, than well and accurately by plainly visible phenomena of astronomy. Had he been able in this

case to show that Egypt, instead of being an almost rainless and cloudless land, was perpetually and for ever in a plague of darkness and mist, men would have been thankful for the idea of the magnetic needle, whereby alone to give any definite direction to the walls of the mightiest masonic fabric their nation had ever erected.

Astronomical azimuths the most exact.

But when they were not alone dependent on the faint and fallible indications of a magnetized needle, but had the glorious sun by day, and the exact stars by night, to refer to all the year round, there can be no doubt by which method good practical workmen would prefer to fix the polar direction of the lines of this, their chief and most durable, building.

Let us, however, now return to our bounden investigation, viz., as to any possible latitude markings about the Pyramid.

Pyramid section in Plate III. Fig. 2.

To this end, there is represented, in Fig. 2 of Plate III. a vertical meridian section of the Great Pyramid, on the same scale as in Fig. 1, page 12; but instead of the large square of the base there given, there is here drawn a much smaller square, though located in a similarly symmetrical manner.

Now this small square, we venture to imagine a very important figure in the theory of the Pyramid. It is not a material existence, even with less claim to that

state than the meridian section. But inasmuch as that feature seemed actually, in consequence of its immateriality, to possess a special depth of meaning, so does there seem to be an importance connected with this small square, almost in proportion to its not being one of those external features, which immediately strike the senses of any casual beholder.

The square of the "Section-area."

The size of the square is determined by the area of the meridian section of the Pyramid; and as this has a vertical height of 116·5 metrons, and a base of 183 metrons, —the square must have a side of 103·246 metrons.

That this square was regarded as fundamental by the builders of the Pyramid, appears, amongst other reasons, from the following :—

A fundamental figure in the Pyramid.

The topmost side marks the position of the topmost "chamber of construction," the highest known hollow portion of the Pyramid.

One-third of the semi-diameter, below that side, marks the level of the floor of the King's Chamber: see the dotted line drawn on Fig. 2 of Plate III.

Two-thirds of the same below the same, mark the floor of the so-called Queen's Chamber.

One-half below the centre, marks the floor of the "Subterranean" chamber, the third and last known chamber in the Pyramid.

And, if there be any truth in Herodotus' reputed tradition of a deep well descending from that subterranean chamber, and terminating in another, perpetually subaqueous, by reason of being below the level of the Nile, and holding there the tomb of the founder of the Pyramid, for ever flowed about by water,—it will be situated close to the position of the lower side of that remarkable square.

Angles given by that square in Plate IV. Fig. 1.

Proceeding now with that same square and the Pyramid section, in its own circle (*i.e.*, a circle with radius equal to the height of Pyramid, drawn from middle of base as a centre), to Plate IV. Fig. 1—

Let us draw a line from that centre through one of the upper corners of the square. That will mark an angle of 45°.

Again draw a line from the same centre, to the point of intersection of the upper side of said square produced as far as the bounding circle, and that will show an angle of 26° 18′.

And once more draw a line from the same centre, to the same upper side produced, but intersected now by a dotted arc, belonging to a circle whose area is equal to the area of the base of the Pyramid,[1] and whose centre coincides with that of the base of the

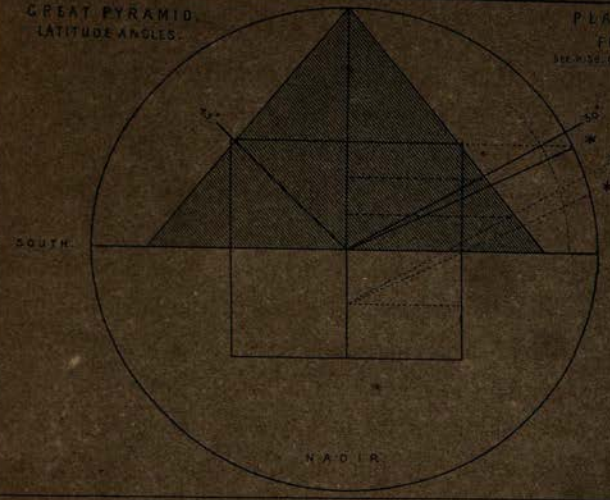
[1] The radius of this circle is = 103·2467 metrons.

PLATE 4.

GREAT PYRAMID.
LATITUDE ANGLES.

FIG. 1.

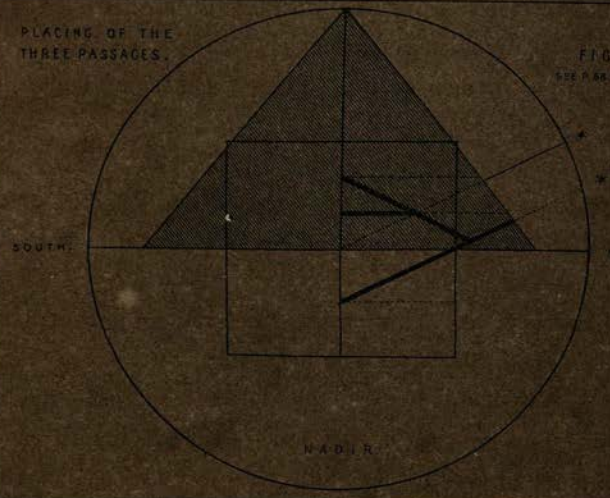
SEE P. 39 ON S. PART I.



PLACING OF THE
THREE PASSAGES.

FIG. 2.

SEE P. 88 ON S. PART I.



Pyramid; then will that line mark out an angle of 30°.

We may say 30°, when taking account only to minutes; but it is a very small quantity below 30°; being rather 29° 59′ 59·2″, when side and double base of Pyramid are taken as 116·5 and 366·0; or 29° 59′ 59·9″, if the residual incommensurability, alluded to in Chap. III. p. 28, be taken into the calculation. Latitude angle.

Plainly, therefore, if we had adopted any of those very erroneous angles for the sides of the Great Pyramid, which were believed in before Colonel Howard-Vyse's discovery of the casing-stones, we should have been thrown out exceedingly in this resulting angle of astronomical indication; for such we must regard the angle of 30° just obtained. And an additional sign that it is so, is offered by its accompanying line and angle of 26° 18′; which is close upon that of the Pole-star of the world in or about the year 2400 B.C., according to Sir John Herschel in Colonel Howard-Vyse's second volume, pp. 107-109. Pole-star angle.

We have not indeed yet discovered any marks on the outside of the Pyramid where these lines of 30° and 26° 18′ pass through it; but it may be noticed, that the first dotted level of one-third, falls between their places of intersection. And then again, if we

transfer these two angles to the level of one-half below the centre, the two new directions for angles of 30° and 26° 18′, which we then obtain, cut the sides of the Pyramid in a place where the level of the second one-third also falls between them.

Theoretical placing of the entrance passage.

Not only so; but by reference to the best sectional elevations and measures of the Pyramid, the place of this second direction-line of 26° 18′, or *′, as we have called it on the Plate, turns out to be the very position and the very angle of the entrance-passage into the Pyramid; an entrance which it has puzzled all men to say, why it was so high above the base, and why it descended at so strange an angle, unless, indeed, to look at the then Pole-star at its lower culmination.

Placing of other passages in Plate IV. Fig. 2.

Following up this remarkable coincidence, therefore, in Fig. 2 of Plate IV., and having marked the said entrance passage by a very dark line to distinguish it—if we draw a line at an equal but opposite angle from the inner end of the level of one-third, it cuts the entrance passage at an anomalous-looking point; but, as measures of the Pyramid show, it cuts it as correctly as can be ascertained, at the very point where the ascending passage does branch off from the descending or entrance one.[1] And finally, if from the place of

[1] A very ingenious book was published by a highly inventive man, Mr.

intersection of this new ascending passage, and the * or 26° 18′ line, we draw the remaining portion of the second level of one-third distinctly black—that will be found to mark the horizontal passage to the so-called Queen's Chamber.

So far as known from the reports of travellers, the Queen's Chamber passage is accurately level, but with regard to the descending and ascending passages, the best accounts vary between 25° 55′, the smallest, ascertained by M. Jomard; and 26° 41′, the largest, measured by Colonel Howard-Vyse; whence it would seem, that our theoretical angle is not to be thought lightly of. Angles of passages.

Indeed, having commenced the inquiry of this chapter with only one particular object in view, we have now not only gained that, but have in addition found a star-pointing capable of fixing the antique date of the structure for its own latitude, besides localizing every passage proper, and every known chamber throughout the whole Pyramid.

H. C. Agnew, in 1838; wherein, on Plates VI. VII. and VIII., he attempts to give the placing of the passage lines in the Pyramid; but as he puts the point of divergence of the ascending passage in the base of the Pyramid, and makes the distance thence to the junction of the horizontal passage somewhat less than half the remainder, in place of being only about one-third shorter—see Col. Howard-Vyse's sectional elevation, or our Plate v. —there must be a crucial failing in his system.

Let us, however, endeavour to prove this practical point with somewhat more precision than the very small size of the figures on Plates III. and IV. have allowed. Plate V. is accordingly a larger and very careful copy of Colonel Howard-Vyse's vertical section from N. to S. through the centre of the Great Pyramid, giving everything there discovered up to, and including, his own time; and nothing more has since been elaborated by any one else at the place.[1] Upon this sectional elevation, therefore, we have applied the lines of our geometric construction, marking them with very open dots; while the lines of internal construction actually found by the Colonel to exist, are marked with continuous lines; and the general surface of Pyramid, ground, and water level are distinguished by coloured shading. On examination it will be seen, that the lines for the passages are contained in, or upon, the passages themselves to a large part of their whole extent; and deviate, if at all, only for matters of constructive detail. The centres of the two upper chambers are, moreover, on the exact level of the latitude points from C and C′ on

Further testing of the theory on large Plate V.

Closeness of theory and observation.

[1] Colonel Howard-Vyse has truly made a noble epoch for himself in the history of the discovery of the Great Pyramid's interior arrangements; and it will be found by the reader that recourse is constantly necessary, throughout this book, to one or other of the discoveries which he was led to make in that long inquiry, into which he voluntarily threw his purse, his time, and all the power of his energetic mind.

the outside of the Pyramid;[1] and the only parts unrepresented by the geometrical construction are, the upper, or false, well, and the two air-channels: the abortive horizontal offshoot, and the equally abortive, or choked, descending passage from the subterranean chamber, not being worthy of notice at present. Residual points unexplained.

That upper well being a narrow, irregular passage, and proved by Sir Gardner Wilkinson to have been merely subservient to the convenience of the workmen, when finally leaving the Pyramid, may be passed by; but the air-channels, though far smaller than the passages proper, and far too small for a human being to penetrate through, are, after the first few feet, straight as arrows, are formed in finished masonry, and are just as much communications from the interior of the building, to the outer air, as the entrance-passage itself. The upper, or dry well.

The entrance-passage then, and the two air-channels, are three things that stand completely alone and by themselves, amid all the other mysterious features of this more than mysterious edifice. The air-channels.

Now, of the entrance passage, it has been abundantly

1 By reference to the *plan* of the Pyramid on Plate III., it will be seen that all these vertical meridian sections of the Great Pyramid, and by others as well as ourselves, agree for convenience to overlook the distance of the plane of the passages from the central plane of the Pyramid, and to suppose them all in this latter plane; and it does not, in these inquiries, introduce any sensible error, when duly explained.

proved by various writers, that it is truly in the plane of the meridian as regards azimuth; and for altitude, in the direction of the lower culmination of the pole-star of about 4300 years ago. Well, then, accepting that, one of the air-channels is above the entrance passage; and apparently, for there are no precise observations on record, in the same azimuth, but at a different angle of altitude; and at what angle? Why, if we can trust the best, and almost only observation, it is pointed to the upper culmination of the same polar star,[1] or 33° 42′: so that a mean between these two built passages,—which both debouch, if we may so say, upon the Pyramid's northern face, and work their way through about 200 feet of solid masonry,—will give exactly the latitude angle of the Pyramid. The northern air-channel therefore is thus found, in its position, to be, besides its other uses, the most admirable geodesic complement to the entrance passage; for it prevents all possible doubt as to men perceiving plainly, that though the pole-star was required to be observed through one of the

The Northern air-channel examined.

[1] This determination is based on the carefully-executed plate in Colonel Howard-Vyse's work. A friend, who had kindly undertaken to check these results, made the angle not as above, 33° 42′, but 30°; he had, however, neglected to take into account the portion of the air-channel which is horizontal after leaving the King's Chamber, and which, not being given in the tabular list of measures, renders the large plate the safer ground-work, on the whole, for computing this element from; but it would be highly important to have the whole checked by special survey.

tubes, yet the place of the pole itself, so necessary for defining the latitude of that diameter of the earth given by the height of the Pyramid, is also marked therein. Showing also, that though astronomy be indeed concerned as well as geometry, in deciding the direction of these strangely-formed channels, yet it was not for the purpose of converting the building into a simple astronomical observatory; for the bend in the lower part of the northern air-tube, joined to its very small bore, would completely prevent a human eye from ever seeing the pole-star through it, when completed.

Its geodesic reference.

On the opposite or southern side, again, the other air-channel, also bent at its lower end, is, through its long straight portion, at a very different angle from its northern fellow; and at what angle? Why, at 45°, or precisely that other angle which we set out inquiring for, anxious to see if any indications whatever, either of it or of 30°, were to be found in the Pyramid: and we have now found both of them,—again we must say, if the modern measures and descriptions yet before the world can be trusted to such refinement,—not only marked in its construction and its entrances, but bored, as it were, into its very vitals; so that, even though fifty feet in depth from the outside surface of its mass should be rasped away in time, by barbarous Arabs and

The Southern air-channel, shows an angle of 45°.

mischievous European visitors, the means of procuring correct interpretation of the original objects and intentions of the founders will still remain.

Numerical list of Pyramid measures, further on.

As a useful check upon our possibly fallible copy of Colonel Howard-Vyse's drawing, we subjoin a list of his numerical measures; a list which, though it be only approximate, is nevertheless by far the completest that has been yet prepared by any one of Egyptian fame; and we will now address ourselves to a remonstrance with which we have been favoured, and which it would not be prudent to pass altogether unheeded by.

Caution pressed upon the author.

Said a very candid friend—"You have worked out, there on paper, some remarkable coincidences, I allow; but are you not going round in a circle; and are not the things which you bring up as confirmations, the very originals themselves in a different dress?"

"A wholesome fear of so doing," answered we, "has been perpetually before our eyes; we are not aware yet of having made such a blunder, but perhaps you can perfect our vision."

"Well!" said he, "there's that latitude case of 30°, or, to please you, 29° 59′ 59·2″, which you get from such and such a geometric construction, dependent on the measured height and base-breadth of the Pyramid; and you prove that it is an astronomical latitude, by the

azimuth, with the pole-star direction appended; and show how close it comes to the French determination in 1799, of 29° 59′ 6·0″; allowing only a little interesting speculation on the latitudes of places having altered fifty-three seconds in 5000 years. Now you had previously used that same height and base-breadth to prove, that the Pyramid symbolized within itself the proportion of the diameter, to the circumference, of a circle. Wherefore, that proportion being once given, and remaining true all the world over, and a good deal further too than the limits of this world, let me tell you,—the poor Pyramid is obliged, wherever it may be put down on the earth, no matter what the real latitude may be, to go on showing 29° 59′ 59·2″; or, be incorrect in its circumference analogy?"

Finality of application in Pyramid proportions.

"Perfectly true," we replied; "there's only one latitude in which the Great Pyramid could preserve alike the truth of its geometric demonstration, and the correctness of its astronomical indication. But then what is the practical argument in the present case, deducible therefrom? why, this, that the Great Pyramid is as happy in its unique situation, as in its extraordinarily exact construction; and that no pyramids that ever have been, or ever will be, erected on the earth in *other* latitudes, will ever be able to compete with the Great

True interpretation.

Pyramid, for richness and completeness of symbolization, in both pure and applied science, and for purposes of time as well as space. While, if we be further enabled before long to illustrate, that the directors of the building of the Great Pyramid were not natives of Egypt, but came into Egypt out of a country having a different latitude, and went back again to that country of theirs immediately after they had built the Pyramid; and that there, in their own country, though great builders in another way, yet they built no pyramids,—will not that go far towards indicating that,—assisted, or not, by a Higher Power,—they had perceived of early time the difficulty which you have just stated, and did expressly and with all intent and purpose select the one and only appropriate latitude, in which to found that most deeply significant structure, the Great Pyramid?"

Indicates design and intention.

APPROXIMATE TABLE OF DIMENSIONS OF THE GREAT PYRAMID. From COLONEL HOWARD-VYSE'S Second Volume of "Operations carried on at the Pyramids of Gizeh in 1837." Appendix, page 109.

Whole Pyramid.

	Feet.	In.	Inches.
Former base, ...	764	0 or	9168
Present base, ...	746	0	8952
Present height, vertical,[1]	450	9	5409

[1] As an example of the little trust to be placed in *one* traveller's measure, alone, of the Great Pyramid, we subjoin the following various notices of the vertical height of the structure. Those with French names attached *may* be in French feet, and, if so, require the numbers to be increased to represent English feet; which would, however, cause them to transcend the sober truth still more than they do; but the number of "courses of masonry" in the pile are quite free from any uncertainty of that order; and, according to the grand *Description de l'Egypte*, every course is continued right through or entirely round the Pyramid.

Name.	Date.	Height in Feet.	Courses of Masonry.
Jean Palerme; . .	A.D. 1581	600	213
Prosper Alpinus, . . .	1591	...	125
Sandys, ...	1610	...	255
J. Greaves, ...	1638	499	207 or 8
De Monconys, ...	1647	520	208
M. Thevenot, ...	1655	520	208
Mr. Melton, ...	1661	520	206
M. Vausleb, ...	1664	662	255
M. Lebrun, ...	1674	676	210
De Careri, ...	1693	520	208
Lucas, ...	1699	729	243
Egmont, ...	1709	500	206
Sicard, ...	1715	...	220
Dr. Shaw, ...	1721	500	...
Pococke, ...	1743	...	212
Dr. Perry, ...	1743	687	...
M. Niebuhr, ...	1761	440	...
Davison, ...	1763	461	206
M. Denon, ...	1799	448	208

	Feet.	In.	Inches.
Former height, inclined, ...	611	0	or 7332
Present height, inclined, ...	568	3	6819
Vertical height, by casing-stones, . .	480	9	5769

Angle of casing-stones, 51° 50′.

Entrance.

Perpendicular height from base to bottom of entrance, ...	49	0	588
Distance of the centre of this entrance eastward from the centre of the Pyramid,	24	6	294
Breadth of passage, ...	3	5½	41·5
Height perpendicular to incline, . .	3	11	47·0

Angle of the entrance passage, 26° 41′.

Length of Entrance Passage.

From beginning of roof to the junction at bottom of upper passage, ...	63	2	758
This passage has lost more than 23 feet of its original length, owing to the dilapidated state of the exterior of the building.			
Thence to the forced passage, . . .	17	10	214
From the forced passage to the Well, .	215	2	2582
From the Well to the subterranean horizontal passage, ...	24	8	296
Total length of inclined entrance passage,	320	10	3850
Subterranean Horizontal Passage—			
Breadth, ...	2	9	33
Height, ...	3	0	36
Length, ...	27	0	324
Subterranean Chamber—			
East and West, ...	46	0	552
North and South, ...	27	1	325
Height, ...	11	6	138

	Feet.	In.	Inches.
Northern side, distant from the centre of the Pyramid, northwards,	8	0	or 96
Eastern side is distant from the centre of the Pyramid eastwards,	25	11	311
Depth from the base of the Pyramid to the roof,	90	8	1088
Subterranean Passage to the southward—			
Length,	52	9	633
Breadth,	2	7	31
Height,	2	5	29

Upper or First "Ascending" Passage.

From the end of the granite blocks to the great passage, including the space of 14 feet 9 inches at present occupied by the granite blocks,	124	4	1492
Height,	3	11	47
Breadth,	3	5½	41·5

Angle 26° 18′.

Grand Gallery, or Second "Ascending" Passage.

Vertical height,	28	0	336
Length to the step leading to the King's Chamber,	150	10	1810
From the step to the passage leading to the King's Chamber,	5	2	62
Total length of Grand Gallery,	156	0	1872
Breadth between ramps,	3	5½	41·5
Breadth of each ramp,	1	8½	20·5
Height of ramp,	2	0	24
Length of passage to the King's Chamber, including the portcullis,	22	1	265
Height,	3	8	44
Breadth,	3	5½	41·5
Height of portcullis,	12	5	169

King's Chamber.

	Feet.	In.	Inches.
North and South,	17	1	or 205
East and West,	34	3	411
Height,	19	1	229
From base of Pyramid to floor,	138	9	1665
Northern side is distant from the centre of the Pyramid, southwards,	16	3	195
Eastern side is distant, eastwards,	26	3	315

There is supposed to be a difference of a quarter of an inch in one of the sides of the chamber, which is probably an inflection in the stone.

Northern and Southern Air-Channels—

Inclined height from base of the Pyramid,	331	0	3972
Distance from east side of King's Chamber,	8	1	97
Height from floor,	3	0	36
Height,	0	6	6
Breadth,	0	8	8
Length from King's Chamber to the outward part of the NORTHERN AIR-CHANNEL,	233	0	2796
Height,	0	9½	9·5
Breadth,	0	9	9
Length from King's Chamber to the outward part of the SOUTHERN AIR-CHANNEL,	174	3	2091
Height,	0	9⅛	9·13
Breadth,	0	8⅞	8·88

The mouth of the southern air-channel in the King's Chamber has been forced, but it was probably of the same size as the other.

Sarcophagus in the King's Chamber, or, the "Porphyry coffer"—

Outside—			
Length,	7	6½	90·5
Breadth,	3	3	39
Height,	3	5	41.

	Feet.	In.		Inches.
Inside—				
Length, ...	6	6	or	78
Breadth, ...	2	2½		26·5
Depth, ...	2	10½		34·5

Passage leading to Davison's Chamber.

Length, ...	24	9	297

DAVISON'S CHAMBER, discovered by Mr. Davison, 1764.

East and West, ...	38	4	460
North and South, ...	17	1	205

Height varies from 2 feet 6 inches to 3 feet 6 inches.

WELLINGTON'S CHAMBER, discovered by Colonel Howard-Vyse, March 30, 1837.

East and West, ...	38	6	462
North and South, ...	17	0	204

Height varies from 2 feet 2 inches to 3 feet 8 inches.

NELSON'S CHAMBER, discovered by Colonel Howard-Vyse, April 25, 1837.

East and West, ...	38	9	465
North and South, ...	16	8	200

Height varies from 2 feet to 4 feet 10 inches.

LADY ARBUTHNOT'S CHAMBER, discovered by Colonel Howard-Vyse, May 6, 1837.

East and West, ...	37	4	448
North and South, ...	16	4	196

Height varies from 1 foot 4 inches to 4 feet 5 inches.

COLONEL CAMPBELL'S CHAMBER, discovered by Colonel H. Vyse, May 27, 1837.

	Feet.	In.	Inches.
East and West,	37	10 or	454
North and South,	20	6	246
Height in the centre varies from 5 feet 10 inches to 8 feet 7 inches.			
Perpendicular height from floor of the King's to roof of Colonel Campbell's Chamber,	69	3	831

Passage leading to the Queen's Chamber.

From North end of the Grand Gallery to the beginning of the low passage,	16	7	199
The low passage to the step,	92	0	1104
From the step to the Queen's Chamber,	17	11	215
Total length of passage,	109	11	1319
Breadth of passage,	3	5½	41·5
Height before step,	3	10	46
Height beyond step,	5	8	68

QUEEN'S CHAMBER.

North and South,	17	0	204
East and West,	18	9	225
Height to commencement of roof,	14	9	177
Extreme height of roof,	20	3	243
Recess in Eastern side—			
Width at bottom,	5	1	61
Height,	15	3	183
Depth to the forced passage,	3	5	41
From the Western side of the chamber to the centre of the Pyramid,	7	6	90
From the Southern side of the chamber to the centre of the Pyramid,	2	10	34
From the base of the Pyramid to the floor of the chamber,	67	4	808

Well, so called; i.e., Upper, or Dry, Well.

Depth of perpendicular shaft,	26	1	313
Thence to grotto,	32	5	389

	Feet.	In.	Inches.
From grotto to the bottom, ...	133	0 or	1596
Total depth, ...	191	6	2298
Square, ...	2	4	28
Height of top of the rock from base of Pyramid,[1]	22	0	264

Note.—As the mouth of the well has been forced through the masonry, Mr. Perring supposes that it was not part of the original design, but, if the upper inclined passage was filled with solid masonry, it was the only way by which the workmen could go out after they had closed up the passage from the upper end of it.

The platform on the top of the Pyramid is about thirty-three feet square; above this are four or five stones belonging to the upper layers.

Conclusions, on Area, and Weight.

	Acres.	Roods.	Poles.
Former extent of base, ...	13	1	22
Present extent of base, ...	12	3	3

Supposing the rock to average eight feet over the extent of base, and deducting the space occupied by chambers and passages, the original quantity of masonry would be 89,028,000 cubic feet.

The present quantity of masonry would be 82,111,000 do.

Or, ... 6,848,000 tons.

And, ... 6,316,000 do.

The space occupied by chambers and passages being only 56,000 cubic feet, or $\frac{1}{1500}$ of the whole mass.

[1] This height, for the judging of which, data are extremely scanty, is given very variously by different authors; some making it 60 or even 90 feet; and the illustrious Bruce, in a fit of jealousy at Mr. Davison's discovery of the small chamber which bears his name (the first and lowest of the five chambers of construction over the King's Chamber), would have it, and held it even unanswerable, that the Great Pyramid is hardly anything else but the original rock of the hill; and that generally, the pyramids were once huge rocks, "standing where they now are." But his assertion that in the exquisite granite ceiling of the King's Chamber "you see large fragments of the rock" of the Pyramid hill, which is limestone,—has met with as complete refutation from the hands of all careful observers from every nation, as any erroneous assertion ever put forward by man.

	Feet.	In.		Inches.
Pavement at the centre of the north front, Width from the original base, ...	33	6	or	402
Thickness of stones, ...	1	9		21

Note.—The chasm discovered in the pavement was about 47 feet 6 inches deep.

The courses of stone in the Pyramid vary from 2 feet 2 inches to 4 feet 10 inches in height.

Mr. Perring's Account of the Shaft sunk in the Subterraneous Chamber, during the Summer of 1838.

Base of the Great Pyramid was above the Nile in 1838, ...	137	3	1647
The rise, that has gradually taken place in the bed of the river, is (according to Mr. Wilkinson) about	10	0	120
	147	3	1767
From the base of the Pyramid to the ceiling of the subterraneous apartment, . .	90	8	1088
Height of apartment, ...	11	6	138
Probable height of any undiscovered chamber, ...	10	0	120
	112	2	1346
	35	1	421

The shaft has been sunk to the depth of 36 feet, = 432 inches.

PART II.

HISTORY, AND THE INTERIOR.

CHAPTER I.—STRUCTURAL ISOLATION OF THE GREAT PYRAMID AMONGST PYRAMIDS.

External differences.

HAD it nothing more to depend on than its external figure, the Great Pyramid might yet be considered as quite unique, both in the purity of its lines and deep meaning of its angles; for though the second and third pyramids of Jizeh do somewhat approach it in form,—they have sensible differences and peculiarities of their own; and before we have got very far away from their neighbourhood, we meet with other pyramids, some of them having distinct re-entering angles half-way down their sides; and others which are built in large inclining steps, known as "the pyramids of Degrees;" and others yet again, more like Indian or Mexican creations; and in such strange shapes at last, as to cease to deserve any classical appellation connecting them with the well-known geometrical solid.

Internal features, more important.

But a more characteristic distinction still, is connected with the interior; for the outside is the mere shell, while the inside is, in a natural history sense, the living being which tenants it; or at least its *quasi* vital end, or life-important purpose, whose functions may haply be deduced by examination of the minuter features of its abode. And yet even here, there is one portion of the whole arrangement which is comparatively inert, and is grown common; *i.e.*, it has been allowed to be often looked upon, and to become well known, and even imitated; requiring, therefore, on such an occasion as the present, to be carefully separated from the rest.

The ordinary, and extra-ordinary, interior features of Great Pyramid.

To this end, an eye-reference to the engravings, Plates VI.-X., will much assist the judgment. Amongst them, Plate VI. Fig. 1 exhibits a meridional section of the Great Pyramid, as it stood in the early ages of the world, but with the secret of its nature upon it, clothed complete with its polished casing-stones, bounded on every side by perfect planes, terminating in a point above, rising from a duly levelled area of rock-surface below; and containing an inclined descending passage leading to a subterraneous chamber, from which are two branches, one tending southward and horizontally; the other, vertically downwards.

Plate VI. Fig. 1.

This portion of the internal construction, reason for believing, was all that the Egyptians th selves knew of, from within a generation after th Pyramid had been built, to the latest times of their nation. That they knew this much, we may readily allow, because they could hardly have known less of the interior than the Romans, and there is proof that *they* were once inside the subterranean chamber. There appears also to be some probability as to pyramids, with this single characteristic, but of poor workmanship, being indigenous in Egypt before the erection of the Great Pyramid; which in that case, therefore, began in so far, in deference to native ideas: improving that plan, however, so extraordinarily, that it was essentially the Great Pyramid version of it which the Egyptians subsequently repeated in so many of their later pyramids. In the second, and also the third Jizeh pyramid, they did indeed attempt (see Plate VIII. Figs. 1, 2) to introduce a certain amount of complication; but it was only useless and confusing complication, without any very sensible object; unless when it was to allow a second king, to make himself a burial-chamber in the pyramid-cellar already occupied by a predecessor, and then it was bad. Gradually, therefore, as the researches of Colonel Howard-Vyse have shown, on the fourth,

The subterraneans only.

Plate VIII.

[redacted]h, seventh, eighth, and ninth Jizeh pyramids (Plate IX. Figs. 1, 2), the native Egyptians dropped everything that they had tried except the one, single, partly descending and partly horizontal passage, with a subterranean chamber for burial purposes.

Moreover, that this is precisely what the Egyptians usually did when they were their own masters and the directors of their own works; and that they did little more, except to decorate them with images of false gods, and hieroglyphic writing, is also testified to from quite another quarter, as may be seen in our Plate X.: for that is copied from George R. Gliddon's *Otia Ægyptiaca*, and adds his American, to Lepsius' Prussian, Bonomi's English, and the Champollionist disciples' French testimony, to the effect,—that what is there represented is "the law of Egyptian pyramid building," as discovered and proved by Lepsius, and satisfying all the observed or known phenomena; asserting, too, that its object was solely a royal tomb,—subterranean as a matter of course,—that it began by making such a subterranean chamber with inclined descending passage; went on growing every year of the king's reign by a new layer of stones over a central nucleus on the earth above the tomb; and was finally, on the king's death, finished off by his successor, who pared

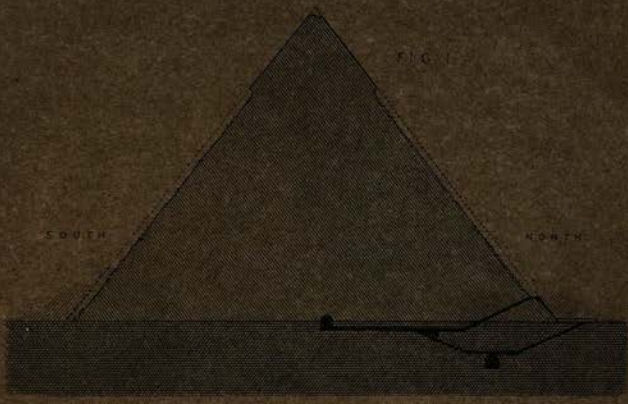
Plate x.

Lepsius' Pyramid-building theory.

SUBSEQUENT PYRAMIDS
BY EGYPTIANS
IN MERIDIAN SECTION

PLATE B

FIG 1



SECOND PYRAMID OF JIZEH. AFTER COL HOWARD VYSE.

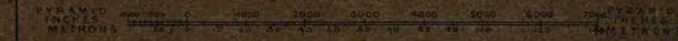
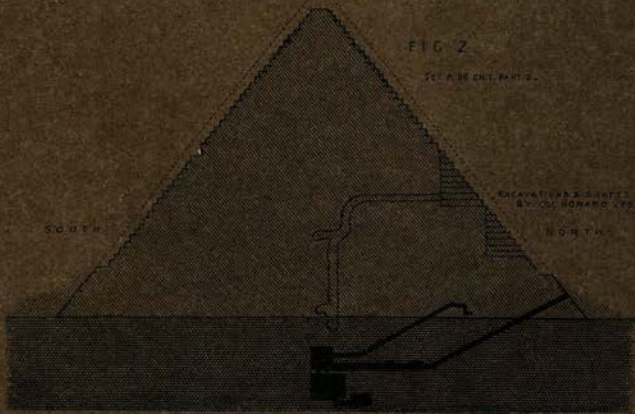


FIG 2



THIRD PYRAMID OF JIZEH. AFTER COL HOWARD VYSE.

SUBSEQUENT PYRAMIDS, BY EGYPTIANS.

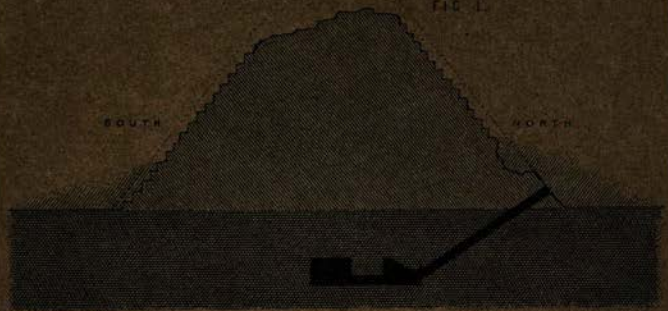
IN MERIDIAN SECTION.

PLATE 9.

SEE P. 76 OF I. PART 2.

(CONTINUED)

FIG. 1.



5TH 7TH 8TH & 9TH PYRAMIDS OF JIZEH, APPROXIMATELY. AFTER COL. HOWARD VYSE.

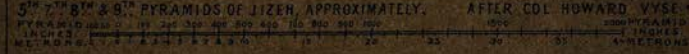
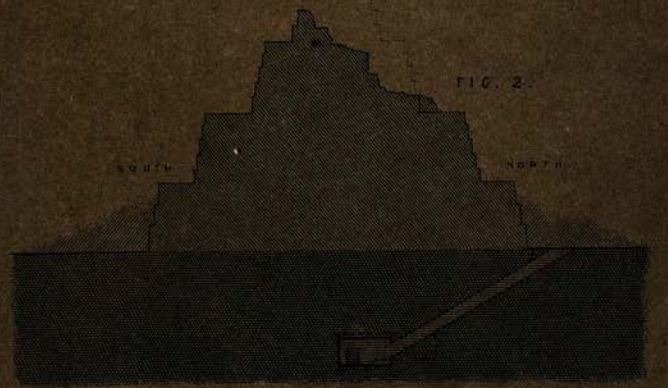


FIG. 2.

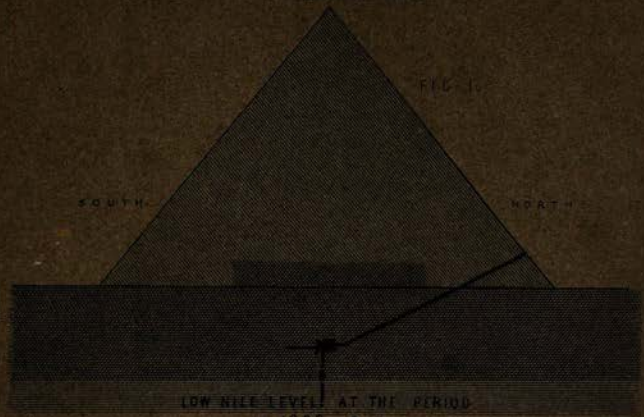


4TH & 6TH PYRAMIDS OF JIZEH, AFTER COL. HOWARD VYSE.

PROGRESS OF HUMAN KNOWLEDGE
TOUCHING THE INTERIOR OF THE GREAT PYRAMID
IN MERIDIAN SECTION.

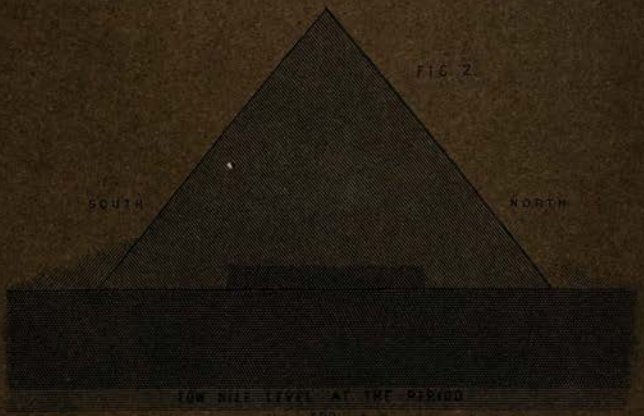
SCALE 5
FEET TO AN INCH

FIG 1.



LOW NILE LEVEL AT THE PERIOD
IN 1900 B. C.

FIG 2.



LOW NILE LEVEL AT THE PERIOD
IN 800 A. D.

PLATE 7

PROGRESS OF HUMAN KNOWLEDGE
TOUCHING THE INTERIOR OF THE GREAT PYRAMID
IN MERIDIAN SECTION

FIG. 1

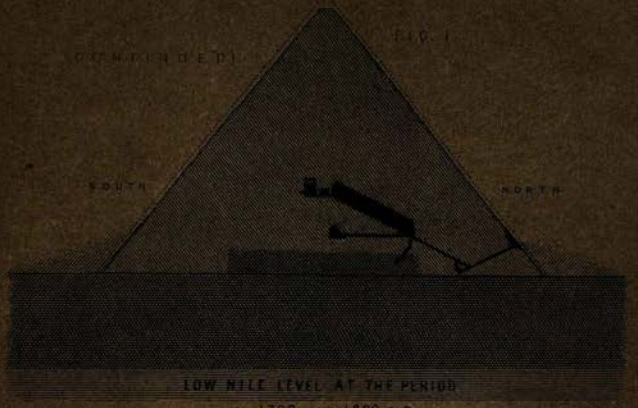


FIG. 2.

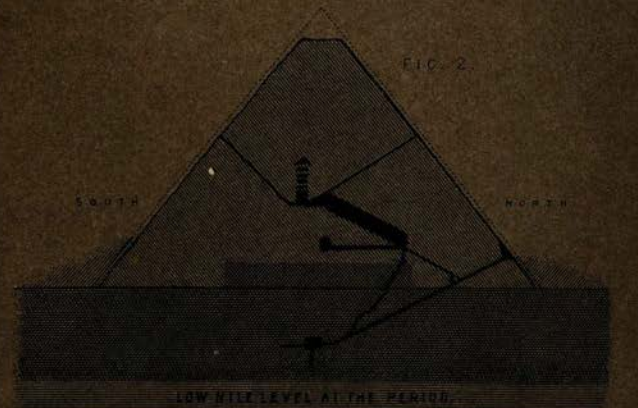
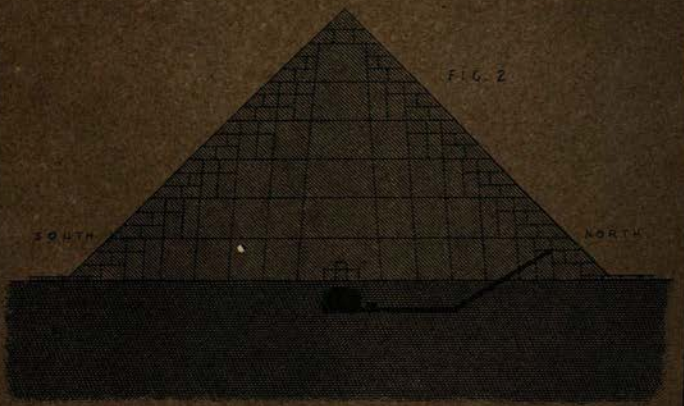


PLATE 10

FIG. 1.

FIG. 2.



THE "LAW OF EGYPTIAN-PYRAMID BUILDING"

AFTER LEPSIUS, WILD, BONOMI & GLIDDON.

IN MERIDIAN SECTIONAL ELEVATION.

away the corners of the square blocks of the casing-stones *in situ*, as shown by the diagram.[1]

Egyptians understood Pyramids only as tombs.

Contrasting, then, Plate X. with Plates VI. and VII., we see clearly that the Egyptians settled down at last to use merely such portion of the Great Pyramid, as Plate VI. Fig. 1, shows, for sepulchral purposes; and it certainly does not a little realize the ideas among some early nations, of burying their monarchs "*sub montibus altis*," in impressive quiet and immoveable calm, and deep in the bosom of mother earth.

[1] In Lepsius' Letter VII., March 1843, he says distinctly enough with regard to the above theory,—"I discovered the riddle of pyramidal construction, on which I had been long employed;" but in the letterpress attached to Frith's large photographs of Egypt (1860?) by Mrs. Poole and R. S. Poole, the discovery is given categorically to another person. As the passage is accompanied with a very clear description of the theory, there may be advantage in giving it entire from this opposite side; as then proving beyond all doubt, *how much* of the whole internal arrangement of the Great Pyramid, the approved pyramidal theory of modern Egyptologists really accounts for:—

"The principle of their construction was discovered by Mr. James Wild, the architect who accompanied the Prussian expedition. A rocky site was first chosen, and a space made smooth, except a slight eminence in the centre, to form a peg upon which the structure should be fixed. Within the rock, and usually below the level of the future base, a sepulchral chamber was excavated, with a passage, inclining downwards, leading to it from the north. Upon the rock was first raised a moderate mass of masonry, of nearly a cubic form, but having its four sides inclined inwards; upon this a similar mass was placed; and around, other such masses, generally about half as wide. At this stage the edifice could be completed by a small pyramidal structure being raised on the top, and the sides of the steps filled in, the whole being ultimately cased, and the entrance passage, which had of course been continued through the masonry, securely closed; or else the work could be continued on the same principle. In this manner it was possible for the building of a pyramid to occupy the lifetime of its founder without there being any risk of his leaving it incomplete."

Greeks and Romans visited the subterranean portion of interior.

There has been some scholastic question of late years, whether Herodotus, Strabo, Pliny, and others of the ancients or their immediate informants, were ever actually inside the Pyramid; for sometimes it has been maintained that the edifice was inviolably sealed, and that they only mentioned the reports of tradition; and at other times it is averred, that they must have seen something more accurately than through others' eyes, in order to have described so graphically as they did. No doubt tradition and imagination always played large parts in tales of the interior of the Pyramid; but that Romans did once enter that subterranean chamber (Plate VI. Fig. 1) was proved, as we have already indicated on p. 77, beyond a doubt, when M. Caviglia rediscovered it in 1820, and found blackened Roman letters upon its roof.[1]

Methodic entrance thereto.

So far, then, through that descending passage of the Great Pyramid (occasionally, and probably at very long intervals) various nations did penetrate; and for that purpose there were some structural arrangements to give them a sort of difficult aid, for the passage was not built up, but only closed on occasion by a sliding block of stone. The machinery of that sliding block seemed to be perfectly understood, and the working of

[1] Howard-Vyse's *Pyramids*, vol. ii. p. 290.

it served as a safety-valve to the Pyramid-curiosity of early times, which was thus admitted on rare occasions and under very imposing circumstances of form and state, to see the interior of the greatest of all the Pyramids; and then they saw and made acquaintance with —what? The descending entrance passage and the subterranean chamber, but nothing else. Use in ancient times.

In the course of the dark ages even that knowledge was lost, besides the Pyramid being assailed by driving hills of desert sand. Hence, when the Caliph Al Mamoun desired to enter, A.D. 820, there was only a very indistinct rumour to guide him, and indicate that the ancient doorway, by which Romans had once entered, lay somewhere on the north side. Thereto accordingly he directed his workmen. They exclaimed, "Open that wonderful Pyramid!"—now more than ever mysterious with its base buried in the sand of the wilderness—and told him, "it could not possibly be done." He only replied to them despotically: "I will have it certainly done." So there was to be no evasion on their parts, and with the toilsome instruments of those crude barbaric days, hammers, fire, and vinegar, they commenced quarrying into the northern side of the Pyramid; and they began exactly in the centre, or half-way between the eastern and western sides; precisely, says Lost in the dark ages. Caliph Al Mamoun determines to enter.

Sir Gardner Wilkinson, as the founders of the Pyramid had foreseen, when they placed the entrance some twenty-four feet east, away from the middle point.

Al Mamoun's descent, and objects of search.

Al Mamoun, the son of Caliph Haroon al Rasheed, of the Arabian Nights, lived in the very prime of the power of impetuous Muslim potentates, and listened eagerly to the rhapsodies of his court poets; who, each one, emulating the enchanted tales of Bagdad, drew gorgeous pictures of the contents of the interior of the Great Pyramid, that mighty and mysterious fact so patent to the eyes of all Cairo; and in describing these matters, the reciters seemed only intent on putting in everything of value they could possibly think of. All the treasures of "Shieddad Ben Ad," the great ante-diluvian king of the earth, with all his medicines and all his sciences, they declared were there, told over and over again. Others again were positive that the founder-king was no other than Saurid Ibn Salhouk, a far greater one than the other; and gave many more minute particulars, some of which are at least interesting to us in the present day, as proving, that amongst the Arabians of nearly 1000 years ago, the Jizeh Pyramids enjoyed a pre-eminence of fame, vastly before all the rest of the Pyramids of Egypt put together; and that if any other is alluded to after the Great

Belief of the times.

Pyramid,—which has always been the notable and favourite one, and known then as the East Pyramid,—it is either the second Jizeh Pyramid, under the name of the West Pyramid; or the third Jizeh Pyramid, as the Coloured Pyramid, in allusion to its red-granite, compared to the white marble casing-stones of the other two; which, moreover, from their more near equality of size, went frequently as "the pair."

Jizeh Pyramids always conspicuous.

But what seemed more to the purpose of Al Mamoun at the time, was, the romancing account of Ibn Abd Alkokm, as to what was still to be found in each Pyramid; for this was what, according to him, King Saurid had put into them:—

"In the Western Pyramid, thirty treasuries, filled with store of riches and utensils, and with signatures made of precious stones, and with instruments of iron, and vessels of earth, and with arms which rust not, and with glass which might be bended and yet not broken, and with strange spells, and with several kinds of *alakakirs* (magical precious stones), single and double, and with deadly poisons, and with other things besides. He made also in the East Pyramid divers celestial spheres and stars, and what they severally operate in their aspects; and the perfumes which are to be used to them, and the books which treat of these matters.

Reputed contents of Second Pyramid.

Of Great Pyramid.

Reputed contents of Third Pyramid.

He put also in the Coloured Pyramid the commentaries of the priests in chests of black marble, and with every priest a book, in which were the wonders of his profession, and of his actions, and of his nature; and what was done in his time, and what is and what shall be from the beginning of time to the end of it.

Reputed guardians of the three Jizeh Pyramids.

"He placed in every Pyramid a treasurer; the treasurer of the Westerly Pyramid was a statue of marble stone, standing upright with a lance, and upon his head a serpent wreathed. He that came near it, and stood still, the serpent bit him of one side, and wreathing round about his throat, and killing him, returned to his place. He made the treasurer of the East Pyramid an idol of black agate, his eyes open and shining, sitting on a throne with a lance; when any looked upon him, he heard on one side of him a voice which took away his sense, so that he fell prostrate upon his face, and ceased not, till he died.

"He made the treasurer of the Coloured Pyramid a statue of stone called *albut*, sitting; he which looked towards it was drawn by the statue, till he stuck to it, and could not be separated from it, till such time as he died."

Some of these features were certainly not very agreeable; but then they were qualified by other tale-

reciters, who described "three marble columns in the Great Pyramid, supporting the images of three birds in flames of fire. Upon the first was that of a dove, formed of a green stone; upon the second, that of a hawk, of yellow stone; and upon the third, the image of a cock, of red stone. Upon moving the hawk, a door which was opposite, composed of great marble slabs, beautifully put together, and inscribed with unknown characters, was raised; and the same connexion existed between the other images and their doors."

Further reputed contents.

Great wonders, of course, appeared beyond these doors; amongst others, "on a green column, another image of a cock made of precious stones, whose eyes enlightened all the place;" and then there was a large hall, "where a quantity of golden coins were put up in columns, every piece of which was the weight of one thousand dinars."

The chief treasure.

But what need to disentomb these Arabian romances further? In Egypt, they believe pretty seriously in enchantments still; how much more then in the days of the son of Haroon al Rasheed, and when the Great Pyramid was entirely sealed? To ascertain what really existed inside it then, was evidently a very definite sort of labour; and why should *not* the Caliph Al Mamoun undertake it? He did so; and with all the fervour and

Al Mamoun commences the search.

fury of an Oriental despot. While occupied with it, he knew no rest; his followers quarried by night and by day into the obdurate masonry; the progress, though slow, was so persevering, that they had penetrated at length no less than 100 feet in depth from the entrance. After that, however, they were beginning to despair of the hard and hitherto fruitless labour; and to remember tales of an old king, who had found, on a calculation, that all the wealth of Egypt in his time, would not enable him to destroy one of the Pyramids. They were almost becoming rebellious, when one day, in the midst

Strange accident.

of their murmurings, they heard a great stone fall in a hollow passage, within no more than a few feet of them.

In the fall of that particular stone, there seems to have been an accident, that was more than an accident.

Energetically they pushed on after that; hammers and fire and vinegar being employed again and again, until they reached the hollow way, "exceeding dark, dreadful to look at, and difficult to pass," they said at

Its remarkable revealment.

first, where the sound had occurred. It was the same hollow way where the Romans of old, and if they, also Greeks, Persians, and Egyptians, must have passed up and down; tame and simple to them, but now with its chief leading secret exposed. A large angular-fitting

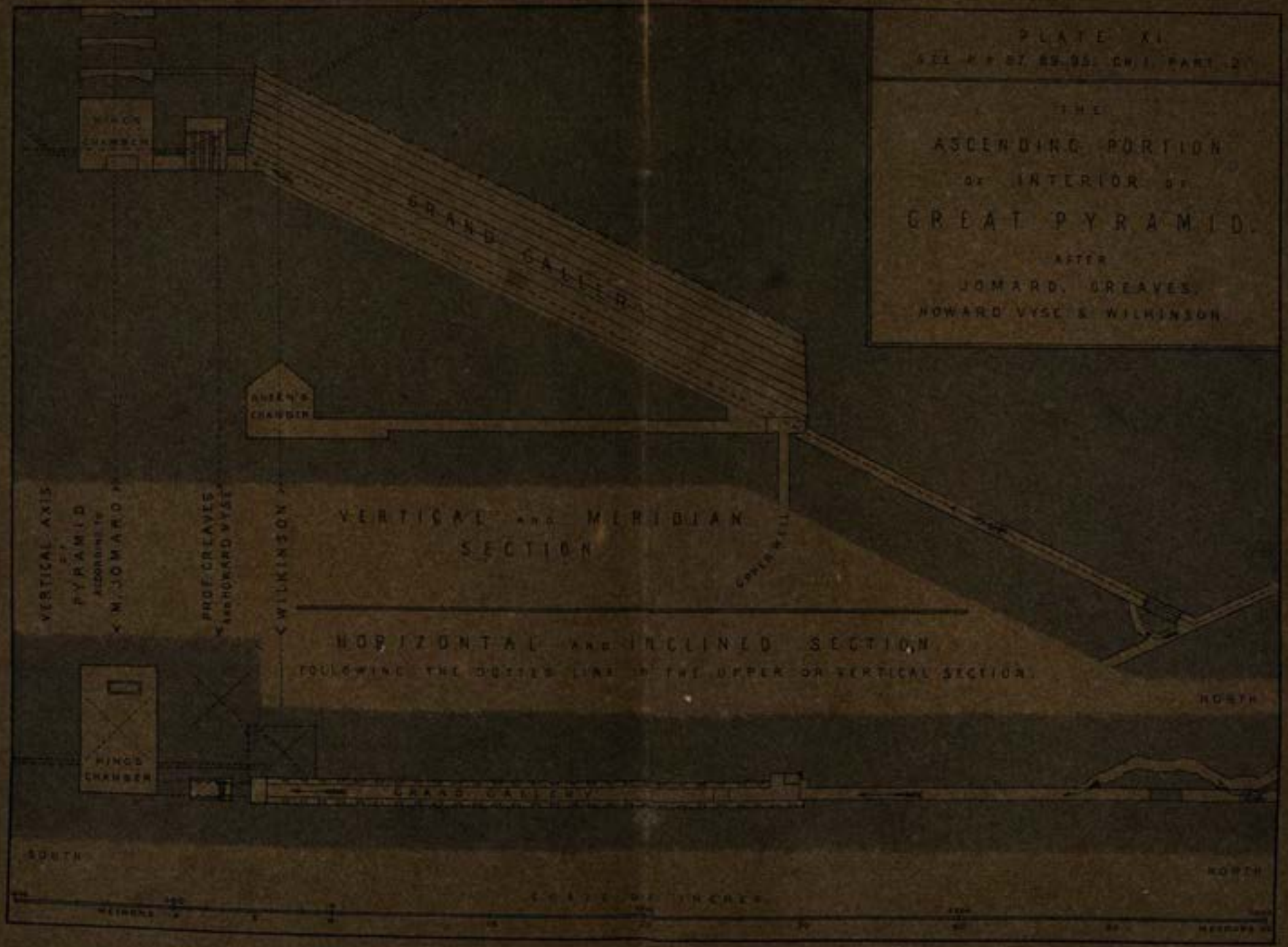


PLATE XI
SEE P.P. 87, 88, 95 CH. I. PART 2.
THE
ASCENDING PORTION
OR INTERIOR OF
GREAT PYRAMID.
AFTER
JOMARD, GREAVES,
HOWARD VYSE & WILKINSON.
KING'S CHAMBER
GRAND GALLERY
QUEEN'S CHAMBER
VERTICAL AXIS OF PYRAMID ACCORDING TO M. JOMARD &c.
PROF. GREAVES & HOWARD VYSE
WILKINSON
VERTICAL and MERIDIAN SECTION
HORIZONTAL and INCLINED SECTION
FOLLOWING THE DOTTED LINE IN THE UPPER OR VERTICAL SECTION.
KING'S CHAMBER
GRAND GALLERY
SOUTH
NORTH
SOUTH
NORTH
SCALE OF INCHES

stone that had made for ages a smooth and polished portion of the ceiling of the lonely and narrow passage, undistinguishable from any other part of its course,—had now dropped on the floor before their eyes, and revealed that there was, at that point, a passage beyond and above; ascending out of this descending one!

An ascending passage discovered.

But that ascending passage was closed by a granite portcullis; not built in, or built up, as if never intended to be entered; but merely left portcullis down; a portcullis of finished workmanship, and intended to be raised in its regular grooves when the proper time and the right man should have arrived. Meanwhile, it was of most portentous weight, and the crew who had gathered about it were decidedly not the right men; accordingly, unable to lift the true gate, they broke in sideways and round about through the smaller masonry, and so up again into the ascending passage, at a point past the obstruction. Then the treasures of the Pyramid, sealed up almost from the days of Noah, and undesecrated by mortal eye for 3000 years, lay full in their grasp before them.

Its portcullis obstruction.

In Plate v. and also Plate xi. this ill-conditioned entrance round the portcullis-block of the ascending passage, may be observed.

On they rushed, that lawless crowd, thirsting for the

promised wealth. Up no less than 100 feet of the steep incline, crouched hands and knees and chin together, through a passage of royally polished marble, but only 41 inches in height or breadth, they had painfully to crawl with their torches burning low. Then suddenly they emerge into a tall gallery (see Plate XI.); in front of them, on the level, another low passage leading to an inconsiderable room; on the right hand, a black, ominous-looking well's mouth; and onwards and above them, a continuation of the glorious gallery or hall leading on to all the treasures of the earth. Narrow, certainly, was the way, only 6 feet broad anywhere, and contracted to 3 feet at the floor; but rising to a height of 28 feet, almost above the power of their smoky lights to illuminate; and of polished glistering marble-like cyclopean stone throughout.

Al Mamoun enters the long-sealed passages.

That must surely be the high-road to fortune and wealth. Up and up its ascending floor-line, ascending at an angle of 26°, they had to push their toilsome way for 150 feet more; then an obstructing edge to climb over; then a low doorway in solid granite to bow below; then a hanging portcullis to pass under; then another low doorway; and after that, they leapt without further let or hindrance at once into the grand chamber, which was the conclusion of everything; the

The Grand Gallery.

chamber to which, and for which, and towards which, according to every subsequent writer, in whatever other theoretical point he may differ, the whole of the Great Pyramid was built. The final chamber.

And what find they there? A right noble apartment; 34 feet long, 17 broad, and 19 high, of polished granite throughout; in blocks squared and true; and so large, "that eight floors it, eight roofs it, eight flags the ends, and sixteen the sides;"[1] and all put together with such exquisite skill that the joints are barely discernible to the closest inspection. Its beauty.

Ay, ay, no doubt, a well-built room; but what does it contain? What is the treasure?

The treasure! yes, indeed, where is all the treasure? They look around them and can see nothing of it, and trim their torches again and carry them to every part without any better success. The room is clean, garnished too as it were; and, according to the ideas of its founders, complete and perfectly ready for its visitors, so long expected, so long delayed; but the gross minds who occupy it now, find it all barren: they declare that there is nothing whatever in the whole extent of the apartment from one end to another; nothing, except, *an empty stone chest without a lid.* Its emptiness. Sole object to be seen.

[1] Sandys; 1610.

Al Mamoun is confounded.

The Caliph, Al Mamoun, was thunderstruck. He had arrived at the very part of the Pyramid he had so long desired to see; and had now found nothing, absolutely nothing; that is, nothing that he could make any use of. Then the people about him began to exclaim at his sacrilegious violence, and deplore their waste of time and loss of money. But he was a Caliph of the able day of Eastern rulers; so he had a large sum of money brought from his treasury and buried by night in a certain spot; next day he caused the men to dig precisely there, and they found a treasure of gold; "and the Caliph ordered it to be counted, and lo! it was the exact sum that had been expended in the works, neither more nor less; and the Caliph was astonished, and said he could not understand how the Kings of the Pyramid of old could have known exactly how much money he would have expended in the undertaking, and he was lost in surprise." So the Caliph went home, musing on the wonderful events that had happened; and the King's Chamber and the "granite chest without a lid" were troubled by him no more.

Retires from further search.

Romancings of Arab chroniclers.

The poets of the Court did indeed again tune their lyres, and celebrate their invincible patron's discoveries in that lidless box of granite; a dead man with a

breastplate of gold, and an emerald vase a foot in diameter, and "a carbuncle which shone with a light like the light of day, and a sword of inestimable value;" though, according to some, the whole chest was crammed to the brim, full of gold "in very large pieces." But nothing further of any note was actually done, in a cause which men began now to deem, in spite of their poets, to be absolutely worthless; and in a region more profitless than the desert itself. The way once opened, however, by Al Mamoun, remained then free to all; and "men did enter it," says one of the honestest chroniclers of that day, "for many years; and descended by the slippery passage which is in it:" but with no other result than this, "that some of them came out safe, and others died."[1]

The most honest of them.

[1] A more edifying account, in a moral point of view, was attempted by one "Masondi in the Akbar-Ezzeman."

"Twenty men of the Faiyoum wished to examine the Pyramid. One of them was accordingly lowered down the well by means of a rope, which broke at the depth of one hundred cubits, and the man fell to the bottom; he was three hours falling. His companions heard horrible cries; and, in the evening they went out of the Pyramid, and sat down before it to talk the matter over. The man who was lost in the well, coming out of the earth, suddenly appeared before them, and uttered the exclamations—'Sak, Sak, Saka, Saka,' which they did not understand; he then fell down dead, and was carried away by his friends. The above-mentioned words were translated by a man from Syad as follows:—'He who meddles with, and covets what does not belong to him, is unjust.'"

Or this, which seems to have been composed for the benefit of the Caliph himself, who is described in the third person, as "one who employed three years, and considerable sums, in endeavouring to enter the Pyramid, and

Spoiling the Pyramid's exterior.

Years again, however, after these things, began that despoiling of the outside of the Pyramid, which was carried on by several generations of Cairine Caliphs systematically,[1] until all the squared and polished blocks of the casing (except the two which Colonel Howard-Vyse was to bring to light 800 years afterwards), had been removed and conveyed away for the building of Cairo; and the grand old primeval inscription on the outside of the Pyramid, "engraved," somewhere about the days of Job, "with an iron pen, and lead in the rock for ever,"—what became of it?

The mystery of the final chamber's sole occupant.

Centuries passed by; and then European travellers began to look in at the Pyramid. The Eastern day-dream of wealth had departed, but that empty stone chest still offered itself for explanation. Why was it in such a place of honour? Why was the whole Pyramid arranged in subservience to it? Why was it so unpretending and plain? Why had its lid been forgotten? Why was it empty? Why was it utterly without inscription?

Gradually the notion grew, that it might be a sarco-

who found little or no treasure, but saw an inscription in letters of gold, on the side of the chamber, declaring that the impious violator of the tomb should experience, as his sole reward, the regret of having committed a sacrilegious action without any successful result."

[1] For this state of the Pyramid, which lasted from 1000 to 1815 A.D., see Plate X.

phagus; that it was a sarcophagus; and that it had been intended for "*the* Pharaoh who drove the Israelites out of Egypt, and who, in the end, leaving his carcase in the Red Sea, never had the opportunity of being deposited in his own intended tomb."

Pharaoh and Joseph burial theories.

But this idea was effectually disposed of, for, amongst other reasons, this cogent one,—that the Great Pyramid was not only built, but had been sealed up too in all its more special portions long before the birth even of that Pharaoh. Nay, before the birth of Isaac and Jacob as well; which disposes likewise of the attempt to call the Great Pyramid the tomb of Joseph, "whose mortal remains being carried away by the Israelites in their Exodus, left the vacancy we now see in the coffer."

Cheops and Chemmis burial theories.

Then wrote some, "here was buried King Cheops or Chemmis, but his body hath been removed hence." Whereupon Professor Greaves pointed out "that Diodorus hath left, above sixteen hundred years since, a memorable passage concerning Chemmis, the builder of the Great Pyramid, and Cephren, the founder of the work adjoining: 'Although,' (saith he) 'these Kings intended these for their sepulchres, yet it happened that neither of them were buried there. For the people being exasperated against them by reason of the toilsomeness of these works, and for their cruelty and

oppression, threatened to tear in pieces their dead bodies, and with ignominy to throw them out of their sepulchres. Whereupon both of them, dying, commanded their friends privately to bury them in an obscure place.'"

Failure of burial theories.

So in later years, all these single sarcophagus propositions having failed, they have been merged into a sort of general sarcophagus theory, that some one must have been buried there. And this notion finds much favour with the hierologists, as a school; for these gentlemen will insist on keeping up a hold over the Great Pyramid, as being a valuable part of their art, and a grand chariot to drive withal before the wondering gaze of mankind.

Anomalies of Coffer viewed as a sarcophagus.

They allow, that in no other pyramid, is the *sarcophagus*—as they boldly call the stone chest, or granite box, or marble hot-bath, or porphyry coffer of other authors—contained high up in the body of the pyramid, far above the surface of the ground outside; that in no other case is it perfectly devoid of adornment or inscription; that in no other case has the lid so entirely vanished, leaving behind it no symptoms even of grooves or catch-pins, or other fastenings in the sides of the box; in no other case are the neighbouring walls and passages of the pyramid so devoid of hieratic and every other emblem,—in fact, they allow,

that the porphyry coffer, with all that part of the Pyramid where it is found, and which opened itself so strangely to the eyes of the Arabians after three thousand years of concealment, is entirely unique and peculiar to the Great Pyramid. The coffer, and its chamber, and its passages, form indeed a sort of machinery (see Plate XI.), which is altogether in addition to what the other pyramids possess; while what they have, the Great Pyramid has also; viz., the subterranean chamber and descending passages,—sepulchral-notion inspiring, or actually sepulchral, if you will,—that were enterable at any time through all antiquity.

Coffer and its accompanyings unique in Great Pyramid.

Observe also with the alleged "sarcophagus," a really open stone trough, in the King's Chamber,—that there was no ancient attempt to build it up and about in solid masonry, in the usual manner for securing a dead body inviolate; on the contrary, there were magnificently built marble passages, of a most lasting description, and fit for continued use through long ages; while, finally, the King's Chamber was *ventilated* in the most admirable manner by the "air channels" discovered by Colonel Howard-Vyse; evidently so that men might come from time to time, and look on, and deal with, that open granite trough, and live and not die (see Plate V.)

Ventilation of Coffer's chamber.

But how is it known, or can it be proved, that there are not similar secret recesses in the other Pyramids also?

Such features in no other Pyramids.

Something may be done in this way; *firstly*, with the example of the Great Pyramid to go by, during 1000 years, the others have been abundantly examined, and probed for like features, but without success.

In the *second* place, some of the others have become dilapidated to an extent that should show such chambers, if they were there. And in the *third* place; whereas the third Pyramid of Jizeh has been admired by some authors,[1] as the third and most perfect work of the Pyramid builders, where every excellence of their system was introduced; that very Pyramid was bored centrally and vertically through by Colonel Howard-Vyse (see Plate VII. Fig. 2), without detecting anything but solid masonry, until the subterraneans were finally reached.

Why introduced in Great Pyramid.

What then was the purpose of all that upper system in the Great Pyramid, above the passage descending to the lower chamber? Why was it not made as easy of access to Egyptians and Romans as the other portion; or rather, why was it so entirely concealed from them through all their long historical day?

Hieroglyphics are plainly at a fault here; for, always

[1] H. C. Agnew, *Letters on the Pyramids*, 1838.

excepting the quarry-marks on the unfinished stones in the chambers of construction, there are no hieroglyphics about the porphyry coffer, or even the whole of the Great Pyramid, except those painted upon it so untruthfully only the other day.

Meanwhile, some few good men and true in scientific researches, witness M. Jomard in the celebrated *Description de l'Egypte*, and Sir Gardner Wilkinson in his own works, have begun to express occasional doubts as to whether any dead body of king or other mortal man, ever was deposited in the strangely shaped vessel of the King's Chamber.

Philosophic doubts as to sarcophagus theory.

The actual words of that most philosophic Egyptologist, Sir G. Wilkinson, are: "The authority of Arab writers is not always to be relied on; and it may be doubted whether the body of the king was really deposited in the sarcophagus;" and again, "I do not presume to explain the real object for which the Pyramids were built, but feel persuaded that they served for tombs, and were also intended for astronomical purposes."

Sir Gardner Wilkinson.

This is at variance with another Egyptologist, whose character is still to make, and who writes: "The Pyramids were in all cases tombs, and nothing more. That they were places of sepulture is enough, to any one

acquainted with the character of the ancient Egyptians, to prove that they had no other use; but were it not so, our knowledge of their structure would afford conclusive evidence;" and then follows the author's knowledge of their structure, which leaves out, neatly and completely, all that is peculiar to the Great Pyramid.

Now it was precisely when he was studying its peculiar features, and comparing them day after day with the ordinary forms of old Egyptian pyramids, tombs, sarcophagi, and mummy-chests without number, that the sage M. Jomard—discussing the matter at leisure with the other members of the French Academy then in Egypt—began shrewdly to suspect that the object of the whole coffer itself, and the place it was in, "might be entirely and totally different" from either the treasure-theory of the East, or sepulchral theory of Western minds: and would prove to be something gifted with a very high value indeed, for nations who were far advanced in civilisation and intellectuality. He even fancied that it might have something to do with a standard measure of length; and believed at one time that he had detected an analogy to the then new French mètre, on one part of the coffer side.

M. Jomard's speculations on meaning of the coffer.

Linear Metrology hinted at.

Something of a similar kind had been speculated on by Sir Isaac Newton, more than a century earlier; and

though sufficiently accurate measures at last failed him, yet he did succeed in getting out, so far as he had foundations, a number of instances indicating very forcibly, that certain harmonious proportions of a fixed measure of length, were very rigidly adhered to, in the formation of many of the Pyramid's passages and chambers. Sir Isaac Newton's ideas.

Yet, notwithstanding this beginning, little more was subsequently tried by any one in the same direction; the crowd still belonged to either the treasure, or the sepulchral, schools; and both parties were equally offended at the poverty of the contents of the chamber in general, and the lidless porphyry chest in particular.

Each had expected riches after their own heart's desire, and instead of them merely found this plain stone box; made, indeed, with exquisite geometric truth, rectangular within and without, highly polished, and of a fine bell-metal consistency, in a sort of hard, compact, faultless porphyry. But then it was empty, they said, and the lid was gone. So they were grievously offended at it; and one man, amongst the civilized, wealthy, and educated of modern Europeans, describes harrowingly, that he hit the coffer a bang with the back of an axe, merely to hear what fifty other persons had recorded before him, viz., "that it rings like a bell on being struck;" another actually breaks off a portion The ideas of the ordinary public. They strike the coffer.

for a "specimen;" another tries to do the same and cannot, though he tries with all his might; and then the British soldiers under General Baird tried, and they succeeded only too well;[1] while, finally, Dr. Lepsius, who, Gliddon states, "has been justly termed by the great Letronne, *the hope of Egyptian study*," planted a young palm-tree in the hollow of the ancient coffer; to act as a German Christmas tree, on whose branches he should hang some baubles which he had bought in Cairo, as presents for himself and his Prussian friends, whom he calls "children of the wilderness," on the strength of having been resident for a few months in Egypt.

They tread it under foot.

In the midst of such scenes, illustrating unfortunately what is actually going on in the nineteenth century, comes out Mr. Taylor with the result of his long researches, and says: "The porphyry coffer in the King's Chamber of the Great Pyramid was intended to be a standard measure of capacity and weight for all nations; and all chief nations did originally receive their weights and measures from thence; so that all those peoples who still keep their hereditary weights and measures, though they have lost something in accuracy, and partially concealed them under strange names, and often introduced inconvenient subdivisions, may

Mr. Taylor publishes his coffer theory.

A primeval and complete Metrology.

[1] *Description de l'Egypte;* and Dr. Clarke.

yet trace their connexion substantially with that one, primeval, standard, centre of the Great Pyramid."

Take, for instance, our own case; when the British farmer measures the wheat which the bounty of Providence has afforded him as the increase of his land, in what terms does he measure it? In *quarters.* Instance in proof.

Quarters! Quarters of what?

He, the farmer, does not know; for there is no capacity-measure now on the Statute-book above the quarter; but, from old custom, he calls his largest measure a quarter. British hereditary corn-measure, coincides with coffer of the Great Pyramid.

Whereupon Mr. Taylor adds: "Four of those quarters make up, in a practical sense, exactly the full contents of the porphyry coffer in the King's Chamber of the Great Pyramid; and the name Pyramid, instead of being derived from πῦρ, fire, is derived from πυρὸς, wheat, and μέτρον, measure; signifying 'a measurer of wheat.' That was the leading purpose of the Great Pyramid ages ago, and the true value of its measure has not been sensibly deteriorated, and has not lost its truth in the world, during all the varied revolutions of 4200 years!"

This is a statement which admits of, as well as requires, the most searching examination.

CHAPTER II.

THE PORPHYRY COFFER.

Inquiry: THE problem which is now before us should be both short and simple; merely to determine the cubical contents of the vessel known as the "sarcophagus," or more philosophically and safely, so as not to entangle ourselves with a dangerous theory, "*the porphyry coffer*" in the Great Pyramid; "The only and one thing," says quaint, old Sandys, "which this huge mass containeth within his darksome entrails."[1]

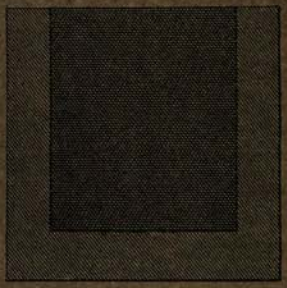
about size of coffer. Of a simple rectangular figure within and without, carved out of a single block, of a moderate size for a man to handle and survey, and accessible on every side, what should present so easy an admeasurement for any educated man to make, as this coffer of the Pyramid? How often, too, has it not been admeasured, and by some of the most learned academicians of Europe!

[1] Sandys' relation, 1632.

THE PORPHYRY COFFER

PLATE 12.

VERTICAL LONGITUDINAL SECTION



VERTICAL
CROSS SECTION

HORIZONTAL SECTION

SCALE OF INCHES.

MODERN MEASURES OF THE PYRAMID-COFFER.

Authors.	Date.	Material as Named.	Exterior.			Interior.		
			Length.	Breadth.	Depth.	Length.	Breadth.	Depth.
	A.D.		Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Bellonius, ...	1553	Black marble	144·	72·	..	..	..	..
P. Alpinus, . . .	1591	Black marble	144·	60·	60·	..	..	..
Sandys, ...	1610	....	84·	47·	Breast-high	..	..	..
De Villamont, . . .	1618	Black marble	102·	..	60·	..	..	..
Professor Greaves, .	1638	Thebaic marble	87·5	39·75	39·75	77·856	26·616	34·320
De Monconys, . . .	1647	....	86·	37·	40·	..	..	..
M. Thevenot, . . .	1655	Hard Porphyry	86·	40·	40·	75·?	29·?	..
M. Lebrun, ...	1674	....	74·	37·	40·	..	..	..
M. Maillet, ...	1692	Granite	90·	48·	48·	..	..	..
De Careri, ...	1693	Marble	86·	37·	39·	..	..	..
Lucas, ...	1699	Like porphyry	84·	36·	42·	74·?	26·?	..
Egmont, ...	1709	Thebaic marble	84·	..	42·	72·?	..	..
Père Sicard, . . .	1715	Granite	84·	42·	36·	..	..	..
Dr. Shaw, ...	1721	Granite	84·	36·	42·	72·?	24·?	..
Dr. Perry, ...	1743	Granite	84·	30·	36·	..	..	..
M. Denon, ...	1799	?	84·	48·	38·	..	..	..
M. Jomard, ...	1799	Granite	90·592	39·450	44·765	77·836	26·694	37·285
Dr. Clarke, ...	1801	Granite	87·5	39·75	39·75	..	..	..
Mr. Hamilton, . . .	1801	Granite	90·	42·	42·0	78·?	30·?	..
Dr. Whitman, . . .	1801	..	78·	38·75	41·5	66·?	26·75?	32·
Dr. Wilson, . . .	1805	....	92·	38·	..	80·?	26·?	34·5
M. Caviglia, . . .	1817	....	90·	39·	42·	78·?	27·?	..
Dr. Richardson, . .	1817	Red Granite	90·	39·	39·5	..	..	..
Sir Gard. Wilkinson,	1831	Red Granite	88·	36·	37·	..	..	..
Col. Howard-Vyse, .	1837	....	90·5	39·0	41·0	78·0	26·5	34·5

N.B.—A note of interrogation after any of the *interior* measures, indicates that they have been obtained by applying to the *exterior* measures the "thickness" as given by the observer; such thickness being supposed to apply to the sides, and not to the bottom.

From Colonel Howard-Vyse's important work are drawn forth and arranged, in the foregoing Table, the chief measures which have been taken between 1550 and 1840; some of the principal authors being consulted in their original writings. Their measures, gener-

ally given in feet, or feet and inches, or mètres,[1] we have set down in inches, to give a clearer view of the progress of knowledge in this particular matter; and now, our only bounds to exactness will be, the capability of these educated men of Europe to apply accurate measure to a regularly formed and exquisitely prepared specimen of ancient mechanical art.

Large limits of error in coffer-measures.

The above list is surely rather appalling. An ordinary carpenter amongst us, talks of sixteenths of an inch quite fluently, and sometimes undertakes to make a special piece of cabinet-work "fit, to half a sixteenth;" but our learned travellers commit errors of several whole inches; and this when they are measuring the Great Pyramid, and the chief object on which the whole structure of the Great Pyramid concentres itself; where too, no less than forty centuries are beholding their proceedings, as they did those of the French soldiers in 1799;[2] and are weighing both them and modern education in the balance together.

We grieve to say that, after the most favourable consideration which we have been able to give them, out of the twenty-five learned authors, no less than twenty-

[1] The feet of all the authors being assumed as English feet, in some cases may require a small correction.

[2] "Soldats! du haut de ces Pyramides quarante siècles vous contemplent."—NAPOLEON IN EGYPT.

two must be discharged summarily, as quite incompetent to talk about size or proportion in any important practical matter. They have also been most unhappily persevering, in only applying their measures directly to the *exterior* of the coffer, when the *interior* is the really valuable feature for theory and use; and is the more lasting one of the two, as a measure, because protected from injury by the very existence of the exterior.

Rejection of twenty-two authorities.

Professor Greaves in 1638, the French Academicians in 1799, and Colonel Howard-Vyse in 1837, are therefore the only three names that deserve to live, as measurers, in the course of 250 years of legions of visitors. Of these three, the foremost position might have been expected for the Academicians of Paris. Professor Greaves lived before the day of European science proper, and when Ptolemy, with sundry Arabian authors, were the only books thought worthy of study after the classical writers of Greece and Rome, and simply because there were no others, or the next thing to it; while Colonel Howard-Vyse did not lay himself out for very refined measurements: but rather went through, what he was obliged to undertake in that direction, in the same fearless, thorough-going, though artless manner in which the gallant Duke of Wellington was accustomed to review a picture exhibition in London, beginning

Of the three authorities retained.

with No. 1 in the Catalogue, and going through with the whole of them conscientiously to the very last on the list.

The Colonel's measures, therefore, are respectable, and solidly trustworthy with regard to large quantities, but not much more.

Of the French coffer measure.

With the French Academicians, however, it is quite another thing; they were the men, and the successors of the men, who had been for generations measuring arcs of the meridian, and exhausting all the refinements of microscopic bisections and levers of contact, in determining the precise length of standard scales. Their measures, therefore, ought to be true to the thousandth, and even the hundred-thousandth part of an inch; and not improbably they are so, in giving the *length* and *breadth* of the coffer; but in giving the *depth*, both inside and out, there seems to have been some incomprehensible mistake committed, amounting to nearly three whole inches.

An anomaly detected.

We have looked up the original authorities in the *Description de l'Égypte*, have reduced the mètre to inches several times, but cannot come to any other conclusion, than that this vital portion of the Academy's work is hugely erroneous. Their length and breadth numbers are not far from a mean of modern

observers; but those for the depth are outside them all, in the most improbable manner to be true.

Under such circumstances, we have been compelled to discharge the French Academy also, from the list of fully trustworthy competitors for usefulness and fame in coffer metrology. Only two names, therefore, are left; Howard-Vyse, whom we have already characterized, and Greaves, in whom we have most fortunately a host indeed.

Of John Greaves; Savilian Professor of Astronomy in Oxford; A.D. 1643.

He lived no doubt before the full birth of European science, but on the edge of a horizon which is eventful in scientific history; immediately behind him were, if not the dark ages, the scholastic periods of profitless verbal disquisitions; and in front, to be revealed after his death, were the germs of the mechanical and natural philosophy which have since changed the face of the world. There is no better a life-point that can be taken than Greaves', whereby to judge what Europe has gained by the exercise of civil and religious liberty, coupled with the study of nature direct, through two and a half centuries of unrestricted opportunity. When as much more time has passed over the world, as separates us from Greaves' age, then—say many of the safest interpreters of the sacred prophecies—a further development of the Christian dispensation will have already commenced.

Of his times.

His devotion to the Pyramid work;

But of Greaves himself, it was somewhat strange, though not inexplicable,[1] that he should make the great exertion he did to visit the Pyramids in the dangerous times of 1638 and 1639; and should, as some of his contemporaries tauntingly observed, though he was a Professor of Astronomy, take so much more care in providing himself with a linear measuring rod, than with any astronomical instruments proper. But the use which he made of that same measuring rod ("a ten foot radius, most accurately divided into 10,000 parts, besides some other instruments, for the fuller discovery of the truth"), when he had entered the Pyramid and approached the porphyry coffer, has something in it,

and to the coffer in particular.

[1] He relates his ideas to a certain extent thus in the *Pyramidographia*:—

"These proportions of the chamber, and those which follow of the length and breadth of the hollow part of the tomb, were taken by me with as much exactness as it was possible to do; which I did so much the more diligently, as judging this to be the fittest place for fixing the measure for posterity; a thing which hath been much desired by learned men; but the manner how it might be exactly done, hath been thought of by none. I am of opinion, that as this Pyramid hath stood 3000 years almost" (this material under-estimate, for what is nearer 4500 years, arises from a mistaken theory of Professor Greaves for identifying Herodotus' name of the Jizeh Pyramid-builders, Cheops, Chephren, and Mycerinus, with kings of Manetho's 20th, in place of his 4th, dynasty), "and is no whit decayed within, so it may continue many thousand years longer; and, therefore, that after-times measuring these places by me assigned, may hereby find out the just dimensions of the *English* feet. Had some of the ancient mathematicians thought of this way, these times would not have been so much perplexed in discovering the measures of the Hebrews, Babylonians, Egyptians, Greeks, and other nations."—GREAVES, vol. i. p. 126.

At page 346, in the "conclusion" of his "Denarius" dissertation, Pro-

which is passing strange indeed. Almost every other visitor, both before and since, paid vastly more attention to the exterior, than the interior, of the coffer. Why, then, did Professor Greaves, when engaged on the exterior, merely give it in feet and inches, as thus, ("the exteriour superficies of it contains in length seven feet three inches and a half,—in depth it is three feet three inches and three quarters, and is the same in breadth"); but when he comes to the interior, why does he immediately address himself to it, as to a matter requiring vastly more accuracy than all that he had been looking to before? "Of the hollow therefore within," the coffer—or as he calls it, "the King's monu-

His exterior measures of coffer.

fessor Greaves gives the following special instances of his measures, which should all be repeated at the earliest opportunity:—

"The first and most easterly of the three great Pyramids in Egypt, hath on the north side a square descent; when you are entered a little past the mouth of it, there is a joint or line, made by the meeting of two smooth and polished stones over your head, which are parallel to those under your feet; the breadth at that joint or line is 3·463 of the English feet"=41·556 Greaves' English inches.

"Within the Pyramid, and about the midst of it, there is a fair room or chamber, the top of which is flat, and covered with nine massy stones; in it there stands a hollow tomb of one entire marble stone; the length of the south side of this room, at the joint or line where the first and second rows of stone meet, is 34·380 feet"=412·560 G. E. Inches.

"The breadth of the west side of the same room, at the joint or line where the first and second row of stones meet, is 17·190 feet"=206·280 G. E. Inches.

"The hollow, or inner part of the marble tomb near the top, on the west side of it, is in length 6·488 feet"=77·856 G. E. Inches.

"The hollow or inner part of the marble tomb near the top of it, on the north side, is in breadth 2·218 feet"=26·616 G. E. Inches.

His interior measures of coffer.

ment,"—he writes, "it is in length on the west side, six feet, and four hundred and eighty-eight parts of the English foot, divided into a thousand parts (that is, 6 feet, and 488 of 1000 parts of a foot) in breadth; at the north end, two feet, and two hundred and eighteen parts of the foot divided into a thousand parts" (that is, 2 feet and 218 of 1000 parts of the English foot). The depth is 2 feet and 860 of 1000 parts of the English foot.

Extraordinary precautions for accuracy.

And he defends his practice in this instance by adding: "In the reiteration of these numbers if any shall be offended, either with the novelty or tediousness of expressing them so often, I may justify myself by the example of Ulug Beg, nephew of Timurlane the Great (for so is his name, and not Tamerlane), and Emperor of the Moguls or Tatars (whom we term amiss the Tartars). For I find in his astronomical tables (the most accurate of any in the East) made about two hundred years since, the same course observed by him when he writes of the Grecian, Arabian, and Persian epochas, as also those of Cataia and Turkistan." "He expresseth the numbers at large, as I have done; then in figures, such as we call Arabian, —— ——, which manner I judge worthy of imitation, in all such numbers as are radical, and of more than ordinary use."

Exactly why, or fully wherefore, it was put into the

heart of this mediæval Oxford Professor of Astronomy to consider, contrary to the usual ideas of other scientific visitors and admeasurers, the numbers for the interior of the coffer so extra-remarkably "radical and of more than ordinary use," we may come to form an opinion by and by; but in the meantime we accept the fact with thankfulness, as the very thing of all others which is directly to the point, where a measure of *capacity* is concerned.[1] Hence we have for the cubical contents of the coffer in English inches, from Greaves' original measures in 1638— Results of coffer measures.

$$77{\cdot}856 \times 26{\cdot}616 \times 34{\cdot}320 = 71{,}118.$$

And by Howard-Vyse's measures, also just as taken in 1837—

$$78{\cdot}0 \times 26{\cdot}5 \times 34{\cdot}5 = 71{,}311.$$

But Greaves' standard measure was already, at p. 32, found too short; and, taking M. Jomard's examination of what was fortunately marked of it by Greaves himself in the King's Chamber of the Pyramid[2] as the best correction extant, we have— Greaves' Scale corrected.

$$77{\cdot}806 \times 26{\cdot}599 \times 34{\cdot}298 = 70{,}982{\cdot}4.$$

[1] To preserve that humility which is equally necessary to insure ultimate success in the paths of scientific research and in a certain narrower and more important way as well, it should be known to Professor Greaves' countrymen, that in his comparatively careless treatment of the *exterior* of the coffer, he made an error of about one inch in the height, and somewhat more in the length.

[2] One foot of Greaves's scale = 0·30460 of a French mètre.

Or if we take that given, not on such good foundation, in Raper's paper in the *Philosophical Transactions* for 1760, we have—

$$77{\cdot}700 \times 26{\cdot}563 \times 34{\cdot}251 = 70{,}692.$$

Howard-Vyse's coffer measure corrected.

And Howard-Vyse's standard was also proved at p. 33 to have been too short; and being corrected as there found necessary to true English inches[1]—

$$77{\cdot}92 \times 26{\cdot}47 \times 34{\cdot}47 = 71{,}096.$$

We have thus obtained five different results for the cubical contents of the coffer in English inches, viz.—

71,118,
71,311,
70,982·4,
70,692, and
71,096,

Best and final result.

the simple mean of which comes out 71,040; but considering that Greaves' extraordinarily careful observations, when corrected by M. Jomard, must be more valuable than all the rest, we may do wisely to take 70,982·4 *English cubic inches*, as the observed capacity of the Great Pyramid's porphyry coffer.

Now, then, what proportion does that bear to the capacity of four modern English quarters, in terms of which British wheat is measured and sold at this very hour?

[1] 764 Howard-Vyse feet = 763·25 English feet.

Cubical contents of four British Quarters.

Referring to the almanac for the Act of Parliament on the subject, we find in our copy a declaration, that the "gill" is equal to 8·665 cubic inches; and then going through the continued multiplications for pints, quarts, etc., up to four quarters, we have for that collective quantity 70,983·680 cubic inches. But in another copy, "one gallon" is declared 277·274 cubic inches; which being similarly multiplied for bushels, quarters, and four quarters, yields 70,982·144 English cubic inches.

Same as one Pyramid Coffer.

Preferring, then, this latter quantity, as having undergone less multiplying than the other, how almost precisely we have therein and thereby, that four English quarters are equal to the ancient Pyramid coffer of 70,982·4 English cubic inches.

Importance of correcting errors of scales.

The exactness of this result may perhaps even surprise Mr. Taylor himself; for although he has brought out something very similar in kind, he has not paid the same minute attention to the corrections required by the traveller's scales; and the only real drag on Pyramid research,—that Pyramid research which he has instituted,—appears to be, the inaccuracy of almost all modern observations made at the Pyramid itself.

So far, however, as the best procurable observations enable us to judge, the ancient coffer represents our

modern four "quarters," with all conceivable practical exactness; and the ancient corn measure of 4200 years ago, is as exactly as any new vessel could now be made, the precise equal of the corn measure of the wealthiest country which the present age of the world can show. The Great Pyramid is in fact still fulfilling the purposes of its ancient name.

Corn-measure superior in importance to other measures.

To nations in a more or less primitive condition, the first application of measures would, with little doubt, be in the exchange of corn; and through whatever subsequent stage of power, or luxury, or refinement they may pass, the measuring of the staff of life will probably still keep up a permanent importance over every other object of measuring or weighing, even though it be of drugs, or silver, or gold,—in perfect accordance so far with our Lord's Prayer, where the only material supplication is, "Give us day by day our daily *bread*."

A principle for testing origin.

Yet it is to be remarked, that if the means for measuring corn were devised by a very superior intelligence, they should be applicable also, so far as principles of accuracy go, to the more artificial and precise purposes to which the after progress of mankind may introduce them; as well as to the rude, original employ.

Thus, the Moon, with its frequently recurring varia-

tions and phases, serves man in the savage state as a rude method of chronicling time over a few months. In a more civilized condition, some of the larger cycles of lunations enable him to speak exactly of many years. In a further advanced condition, its subsidiary features of movement enable the sailor in the midst of the broad surface of ocean to measure his precise longitude; and amongst the strongest minds of the present day, the theory of those movements and the computation of their nature, forms an arena where every man may measure off his own intellectual height, at the base of an infinite cliff, which he may never hope to stand on the summit of.

The Moon, an example in point.

In exact proportion, therefore, as man has been able to profit by the Moon, which he was originally told was merely intended to rule the night, so has it been found capable of more and more applications; and whenever any difficulty has occurred, it has never been any want of perfect accuracy in the lunar machinery itself, but merely in the power of man to interpret the working of it.

The lunar theory, and its difficulties.

Is there, then, anything approaching to the same suggestive principle, connected with the "corn measure" of the Great Pyramid?

Principle to be tried in the Coffer.

There can be no harm in examining; and it will be the surest way of guarding against any possibility of

our having been misled thus far, by some single fortuitous coincidence.

Let us conclude this chapter, however, by a glance at the *material* of this most interesting vessel.

What is real material of Coffer?

A reference to the third column of our Table on page 103, will show that travellers have assigned to the coffer almost every material, from black marble to red granite, and porphyry of a colour which no one has ventured to name. The majority of modern authors are in favour of red granite; but we are notwithstanding, rather inclined for the porphyry, doubting if anything so well known and distinctly marked as red granite, would ever have been called black marble; and having been recently assured by a railway engineer who has been much in Egypt, that "it is undoubtedly porphyry;" an assertion which he backed up by describing some of the differences in character between the material of the coffer, and the indubitable red granite of the walls of the Chamber.

Porphyry preferred.

Where from?

This granite he traced to the quarries of Syene, 550 miles up the river from the Pyramid; for, nearer than that, there is not a particle of granite rock on the banks of the Nile, or within very many miles from them on either side. Porphyry may not improbably be found at Syene, amongst the veins and extravasations of

granite and basalt which there abound; but the most celebrated Egyptian quarries of porphyry were much nearer the Red Sea than the Nile, or at and about the Gebel Dokhan and Mount Porphorytes; in much closer geographical proximity to, and perhaps geological connexion with, the granitic mountains of Sinai, than the plutonic beds of Philæ and Syene.

Porphyry quarries in Africa; between Nile and Red Sea.

Nevertheless, seeing that the quarries at Gebel Dokhan are, we believe, only known to have been worked in the later dynasties, and had their chief fame in the Roman period, it is a matter of open discussion where the porphyry, of such an early construction as the Great Pyramid coffer, came from; as well perhaps as from whence much of the granite of the same structure was derived; for there are great doubts whether the Memphite kings of the fourth dynasty, whose chief strength lay in Lower Egypt, had command of the river far past Thebes, and up to the Syene quarries at the first cataract.

Not the earliest worked by the Egyptians.

In the meantime the researches of modern hierologists have detected the cartouches or ovals, of both King Cheops and King Chephren, or Shofo, and Nou-Shofo, of the Jizeh Pyramids, on certain rocks in the Sinaitic peninsula, near Wadee Maghára; and though the "works," with which these inscriptions were connected, are sup-

Hieroglyphic discoveries eastward.

Porphyry quarries in Arabia Petræa.

posed primarily to have been copper-mines, yet the following original note by Professor Greaves, evidently written long before the day of mineralogy, may be useful in directing attention to the possibility, of some of the more valuable stone material of the Great Pyramid, having been procured from the noble, and soul-inspiring mountains of Sinai. The passage runs as follows :—

"I conceive it," the material of the coffer, "to be of that sort of porphyry which Pliny calls Leucostictos, and describes thus :—'Rubet porphyrites in eâdem Ægypto, ex eo candidis intervenientibus punctis leucostictos appellatur. Quantislibet molibus cædendis sufficiunt lapidicinæ.' Of this kind of marble there was, and still are, an infinite quantity of columns in Ægypt. But Venetian, a man very curious, who accompanied me thither, imagined, that this sort of marble came from Mount Sinai, where he had lived amongst the rocks, which he affirmed to be speckled with party colours of black and white and red, like this; and to confirm his assertion, he alledged, that he had seen a great column, left imperfect amongst the cliffs, almost as big as that huge and admirable pillar standing to the south of Alexandria.—Which opinion of his doth well correspond with the tradition of Aristides, who reports, that in Arabia there is a quarry of excellent porphyry."

Granite and Porphyry from Mount Sinai.

CHAPTER III.

WHY OF THAT SIZE?

British Quarters, and Chaldron, traced to Coffer.

WE have shown indeed the fact that one Pyramid coffer of capacity agrees, according to the best observation ever yet taken, with four English quarters, to within $\frac{1}{100,000}$th part of the whole; and, in so far, have strengthened Mr. Taylor's argument, both that the English hereditary measure was derived in primeval times from that of the Pyramid, and that the old Anglo-Saxon measure called the "Chaldron," in its day the equivalent of "four quarters," was really a close imitation of the said most ancient Pyramid coffer.[1] The chaldron, therefore, was in so far, made of the size

[1] The name "chaldron" Mr. Taylor derives from "hot bath," one of the names which had been given to the coffer by Eastern men, from its figure; and very reasonably, for on referring to Plate XII. Figs. 1, 2, 3, it will be seen that the shape is by no means unsuitable to a marble hot bath. Compare also Colonel Howard-Vyse's portrait of the genuine sarcophagus of the third Jizeh pyramid, with its roof and corniced lid, deep architectural decorations, and cemented fixing-pin holes.

Why was Coffer made of the cubical contents which it now measures?

our ancestors knew it, because that was the size of the Pyramid coffer;—but then why had that particular, and exactly-kept, size been chosen for the coffer? for those certainly primeval men who made *it*, were, in their day, bound by no social example; confined by no human precedent; and were consequently perfectly free to make it of any size whatever, that might then and there seem to them most fit.

Capacity measures not generally treated with respect in metrology.

This affair of the coffer's precise size, is indeed the question of questions; for there is no ready explanation lying on the surface; and the subject, viewed as one of capacity and weight measure, is capable of such peculiar perfectionings, and remarkable refinements, that we may have to dig extremely deep before discovering the real reason. Not that any modern nation has shown a very particular care for the teachings of science, or much acquaintance with nature either, in fixing for themselves the size of their unit or their standard of capacity-measure; having left it hitherto to something very like arbitrary fancy; and seeming to think the subject even still, either an entirely unscientific matter, or one ruled altogether by the standard of linear measure. Thus, the late Mr. Baily, in his report on the standard scale of Great Britain,[1] says after a magnificent peroration in favour of

[1] *Royal Astronomical Society's Memoirs*, vol. ix.

the importance of permanent standard measures, "such measures are usually divided into those of *length, capacity,* and *weight;* but, as the two latter may in all cases be deduced from the former, it will be necessary to consider only measures of length;" and measures of length are accordingly the only ones which he cares to take notice of, in that very large and learned paper.

F. Baily's opinion.

Not very dissimilarly, too, did the French philosophers act, when establishing their metrical system. For after having scorned—in the cause and for the sake of accuracy—to adopt a *short* natural unit for linear reference, such as the seconds' pendulum, lest, in applying it to long distances, errors should creep in by continued multiplication; and having insisted on taking there, a *long* natural unit, and obtaining what they required subsequently by continued subdivision, in that manner producing their mètre out of the meridional distance from pole to equator,—they went the very reverse way to work in obtaining their units of capacity and weight.

Practice of the French mathematicians.

To procure these upon their "linear" principles, they ought to have subdivided the capacity of the shell of the earth, and the weight of the matter in the earth; but they attempted neither the one nor the other. They did not even employ their mètre itself

Their principle in "linear" measures.

in the large, and adopt therein a good honest size for their capacity and weight standard; which they would then be more frequently sub-dividing than multiplying, in the common affairs of daily life; but, as every one knows, they took the $\frac{1}{10}$th part of the mètre, cubed, for the capacity measure; and filled the $\frac{1}{1000}$th part of that with water, for their weight measure.

Capacity measure should have its own natural reference.

They had thus, no doubt, a something which could be referred, through the mètre, to one element in the size of the earth; but if there was such extraordinary mental satisfaction felt at the mètre, a linear human measure, being a neat fraction of a linear length along the earth,—and poor Englishmen have had this flaunted and flouted in their faces unceasingly for fifty years past, until at last it has been formally proposed[1] to abolish the British hereditary measures in favour of the French, because the former are so utterly unscientific, and the latter so perfectly replete with science,—why should there not be mental satisfaction also, when a capacity measure in some way gives us a neat fraction of the capacity of the earth, or at all events reminds us of its shape and capacity-giving power; and when a weight measure gives us a similar proportion of what is

[1] President's opening address at the British Association, Newcastle, 1863.

even more important in nature, viz., the weight, or what goes to make the weight, of the earth?

Weight measure, its natural reference.

There may indeed be some remarkable difficulties in the way of accomplishing this reference; for not only are the arrays of numbers appalling, but there may be some logical doubt as to how to proceed in comparing a weight on the surface, against the weight of each equal portion of a sphere, whose own attraction it is which gives all the appearance of weight to anything laid upon it. The affair is difficult, and perhaps of a transcendental, rather than a practically useful, character; yet not more so than, according to many very eminent men, with able mathematicians amongst their number, is the subdivision of the quadrantal terrestrial arc for a length measure. In the meanwhile, too, the earth *has* a weight, or mass; and not only so, but it is precisely the grand French school of mathematical astronomers, who care not a straw for the *visible size* of sun, moon, or planets; they want only to know their *mass;* and then, having obtained that, proceed in all their admirable calculations,—where so few of us can hold pace with them,—for the orbital movements of these planetary bodies under the influence of gravity, as though the mass were concentred in the case of each separate body, into an infinitely small point at its centre. To them, the high-

Its exceeding importance.

class French mathematicians, in sad truth it is almost an impertinence to be told by the telescope, that the substance of a planet has chosen to expand itself into a globe of such or such a size in miles; or into one large and several small globes as attendant satellites;—they want only to know the weight of the matter contained in each system, simple or compound, and then they will set their equations in array, and compute you any length of orbital consequences.

Scientific deficiency in the natural reference of French *weight* measures.

Why, then, did not those confessedly most acute and extraordinarily able men, when preparing a completely new metrological system for France, and, as they hoped, for the world through France,—give us some symbolization or expression of that which is astronomically far more important than linear measure, viz., the weight, or mass, of the earth?

And in all other modern systems.

Perhaps they did not think of it, or if they did, perhaps they could not devise any means of accomplishing it; certainly they did not do it; nor has any one else amongst men in all the historical period of science: and perhaps, it may not be, in the nature of things, altogether possible.

What of the Pyramid system?

Is it worth while, then, to examine the Great Pyramid of 4200 years ago, to see if any approach to a solution was made there?

Not altogether fair, perhaps; but somehow, from the complexion which this gigantic mass of pure masonry, unvitiated by any idolatrous design, is taking, on being submitted to a searching examination, we have begun to expect high things from it. At present, however, we have merely to inquire, why was the coffer made of the particular size which we now find it to be, viz.,—in cubical contents = 70,982·4 modern English cubic inches, equal to 70,912·2 ancient pyramid inches?[1]

First step of the inquiry, at the Pyramid Coffer.

On opening Mr. Taylor's valuable work[2] with reference to this question, we may see that he had—and quite characteristically of so invaluable an author—*expected* that his reader would require some explanation of this matter. But after perusal, we are sorry to say that what he has written on the subject has not, for us at least, his usual powers of satisfying. He shows, for instance, that the cube-root of the contents of the coffer (with him not quite the same as the above) is equal very nearly to the length of a certain ancient Egyptian cubit, found accidentally some years since at Karnak, and believed to be one of the veritable mason's measures by which the buildings of that day were measured and set out.

Mr. Taylor's idea.

Not, indeed, that Mr. Taylor would imply that that

[1] See page 112.

[2] *The Great Pyramid*, p. 195.

wooden bar was really the original, or that the measure itself was first used in the distant city of Karnak; but without, as far as we can find, putting anything much more distinct than the above into its place, as the reason why the founders of the Pyramid chose to make the coffer of that size, he goes off into a disquisition on its *shape*,—a very able disquisition in itself, but on a much less important question.

Mr. Taylor on the *shape* of the Pyramid Coffer.

That the coffer should be oblong-rectangular in place of simply cubical Mr. Taylor thinks, and probably with great reason, a matter of symmetry and convenience;[1] but why it should be of the precise rectangular proportions it actually was made and still is, he thinks due to a division of the said wooden or Karnak cubit into digits, of which 90 went to form the length, 30 the breadth, and 40 the depth of the coffer.

[1] Taylor's *Great Pyramid*, p. 197:—"But why, it may be asked, was not the coffer made at once in the shape of the cube of the Karnak cubit? From its obvious unfitness, if it were of that shape and size, to serve as a *model measure*. The framers of the standard would naturally have regard to the portability and convenient use of the wooden measures which were to be founded on that model, and if men of the present day would prefer the shape of a *trough* to that of a cube of such inconvenient dimensions, we may give the founders of the Great Pyramid credit for so much common sense as would lead them to the same conclusion. To all the inhabitants of the East the *hot bath* was a familiar object, and in the appropriation of its form to the purpose of a *corn measure* we see how it happened that this vessel received the name of *caldarium* or *chaldron*, or laver. It was that which it had possessed from the earliest times, long probably before its employment as a *corn-measure* had been thought of."

It is noticeable, however, that not only does that arrangement *not* give the absolute cubic-contents with sufficient approximation, viz., short by more than 1500 inches; but that one of the three measures falls entirely out of the *proportion* of the other two; and would imply an error of depth either in the manufacture of the coffer or in Professor Greaves' measure, to an extent which would be preposterous to admit, viz., $\frac{1}{10}$ths of an inch. In fact the Karnak cubit fails to apply to the three divisions of the coffer's length, breadth, and depth, even when divided into its smallest aliquot divisions or digits, much more than when any of the larger divisions are employed; and it is rather surprising that Mr. Taylor did not see that it had distinctly failed.

Proportions of Karnak cubit, fail in representing the measures.

But more surprising still is it, that so mighty an author as Sir Isaac Newton made a similar, though larger failure, and did not see it either. Sir Isaac had taken up the subject of cubits, and their investigation from accurate measures of ancient buildings; and in the use which he makes, more than half a century after Greaves' death, of his measures of the Great Pyramid, we see Newton almost as a prophet of light, stepping from one part of the building to another, and clearly proving it to have been constructed in terms of the

Sir Isaac Newton on Pyramid and Coffer proportions.

cubit of Memphis, or very nearly the common cubit of Egypt in the present day.[1]

Sir Isaac Newton on proportions of King's Chamber.

"That the Pyramid was built," says he, "by the cubit of this magnitude, appears from several dimensions of it. The square passage leading into it of polished marble, was in breadth and height 3·463 of the English foot; that is, two of the above-mentioned cubits of Memphis. And of the same breadth and height were the four other galleries. In the middle of the Pyramid was a chamber most exquisitely formed of polished marble,[2] containing the monument of the king. The length of this chamber was 34·38 English feet, and the breadth 17·19; that is, it was 20 cubits long, and 10 cubits broad, the cubit being supposed 1·719 of the English foot. The roof of this chamber consisted of nine oblong and parallel stones; the seven middle ones of which were of the same breadth, but the two outermost were less by half in breadth than the rest; and the breadth of them altogether was equal to the length of the chamber, or to 20 cubits; so that the breadth of the middle stones was two cubits and a half. The marble gallery which

In terms of the cubit of Memphis.

[1] This cubit is equal nearly to 20·7 inches, and has been used in the Nilometer for 3000 years. The Karnak cubit, above alluded to, is evidently a measure of the same order, being just twice the above, or 41·4 inches English; and is to be regarded merely as a double cubit.

[2] This chamber is of *granite*, which Greaves calls "Thebaick marble."

led into this chamber was 6·87 feet, that is, four cubits of the chamber, in breadth. In the middle of this gallery was a way of polished marble, 3·435 feet, that is, two cubits, broad; and on both sides of the way were two banks like benches, of polished marble likewise, 1·717 feet broad, and 1·717 feet deep; that is, in breadth and depth one cubit. Who will, therefore, imagine, that so many dimensions, not at all depending upon each other, should correspond by mere chance with the length of the cubit assigned by us?"

Sir Isaac Newton on the Gallery measures.

Who is there, too, in the present day, as well as Sir Isaac Newton's own, who will not agree entirely in the above remark?

But it is not altogether the same when the great philosopher comes to that strange enigma, so annoying and inscrutable to all nations and men, from Caliph Al Mamoun, to Napoleon Bonaparte, viz.,—the porphyry coffer, or, as he calls it, the King's monument. Sir Isaac there descends at once from the wholes, or halves, of cubits, which he had found sufficiently close before; and says, in the monument, there "are specimens of the *division* of the cubit. For since the cubit is 1·717 of a foot, and consequently the palm ($\frac{\text{cubit}}{6}$) 0·286 of a foot, ten palms will be 2·86 feet; seven palms and three

On the Coffer measures.

Sir Isaac Newton's Coffer proportions.

digits (a digit $= \frac{\text{palm}}{4} =$ ·0715 of a foot) will be 2·217 feet;[1] and twenty-five palms and two digits will be 7·293 feet. Now, Mr. Greaves found the measure of the height of the monument within, to be 2·860 feet; the breadth within, to be 2·218 feet; and the length of the exterior superficies to be 7 feet 3 inches and a half; that is, 7·292 feet. The height of the monument within, was therefore ten palms; the breadth within seven palms and three digits; and the length of the exterior superficies, twenty-five palms and two digits, without any sensible error."

Imperfect in application.

On first reading this paragraph, we could hardly believe our eyes. What! has the immortal Newton, in taking the three dimensions of a rectangular space, taken two of them from one body and the third from another, and then proceeded to compare them complacently together, as if they had all been taken from one and the same figure! Yes indeed it is too true; and so the least we can conclude is, that the length, breadth, and depth of the *interior* of the porphyry coffer are *not* symmetrical or harmonious together, and even Newton himself utterly failed to cause them to fall in with any aliquot divisions of the scale which he applied to them;

[1] In Dr. Birch's edition of A.D. 1737, this number is printed 2·717, evidently a typographical error.

for, to take two measures of the *interior*, and one of the *exterior*, is the most lamentable begging of the real question which can possibly be imagined.

Error in the exterior measure used by Sir Isaac Newton.

It is even additionally curious that Greaves' measure for the exterior length (7·292 feet = 87·504 inches) was decidedly erroneous by so large a quantity as about three inches (the French measure being 90·592, and Colonel Howard-Vyse's 90·5 inches); so that nothing was gained after all, by making that *erroneous* measure of the outside length, commensurable with the interior breadth and depth, to a chance hundredth of an inch.

Memphis cubit inapplicable to three dimensions of the Coffer.

That there was reason for Newton *not* employing the inside length, with the inside breadth and depth, on his theory, is shown thus: taking the value of the cubits, palms, and digits as he determined them,—the nearest digit approaches to Greaves' inside measure of length, are, 77·265, and 78·123; while what Greaves measured, was, 77·856 inches; and this was true, with little doubt, to $\frac{1}{10}$th of an inch; as the French measure is, 77·836, and Howard-Vyse's, 78·0 inches.

After this, we tried a variety of proportional parts of several cubits, but could get none to fall in evenly with the three measures of the hollow stone; Mr. Taylor's was the best attempt, and even that had failed; so then we began to think that no even number was intended;

and that as the coffer had been formed originally to serve as a measure of capacity, good care had been taken to prevent its being falsely used for measures of length; the function proper to the Pyramid's base.

Conclusions from Sir Isaac Newton's deductions.

Measures of length had been found by Sir Isaac Newton undoubtedly about the passages and chambers; but these were the profane measures of the Egyptian people; and may be regarded merely as showing, that the general architectural work was performed by the labour of Egyptians; in so far confirmatory of the Egyptian quarry-marks on the rough stones of the Chambers of Construction.[1] But, that it was no Egyptian who directed the work to its ultimate objects, or understood what it was for,—is a matter of most growing certainty; and in this porphyry coffer, we have the very closing end and aim of the whole Pyramid.

Varied material of the different passages.

The outer passages and galleries, as Sir Isaac Newton describes, after Greaves, are in a sort of hard limestone or marble; but after proceeding up all the length of the grand gallery in progress to the King's Chamber, a low doorway has to be passed through, and from that point forward everything is in granite; and the style of the work is the most solid and truthful that can well be imagined. From that low door you enter a little

[1] Found by Colonel Howard-Vyse.

ante-chamber, all granite; then through another low doorway and into the final King's Chamber, all granite too: but with that strange coffer standing north and south near the western end; and in a different material again, as much an advance on the granite, as the granite brought from most distant quarries is on the marble; and the marble again from the quarries of Masarah, in the Mokattam hills on the opposite side of the Nile, to the crude limestone composing the very hill on which the Pyramid stands.

Improved material in approaching the Coffer.

When at length driven almost to despair, at not being able to find any sensible reason for the coffer's interior being of the precise size which modern measures reveal it to be—we fell on a recently published paper,[1] which promised great things, and began most admirably thus: —"In what is called the King's Chamber of the Great Pyramid of Egypt, there is a coffer of porphyry, commonly supposed to have been the sarcophagus of the royal builder. This coffer, however, does not resemble an ordinary sarcophagus, and its form presents numerous definite and peculiar proportions, so that it is impossible to conceive the structure to be accidental. Having found the proportions geometrically accurate, the author of this paper believes that this coffer is a

Mr. Joseph Jopling's Coffer theory.

[1] By Joseph Jopling, architect, in the *Leisure Hour*, 1863.

treasure-chest of science, and that its proportions deserve careful observation and study."

Mr. Jopling's theory not agreeable to the measures.

Then followed a theory, based on "squares inscribed or to be inscribed in the circles of the human eye," as an invariable natural unit of length (conveniently small for a popular unit, but very difficult, and highly dangerous to the subject to apply in practice)—and some very astonishing results were brought out, in the play of arithmetical numerations. But on taking the given size of the unit, and the number of them stated to exist in the length, breadth, and depth of the coffer, the results were far wider than any of those which we have already found it necessary to condemn, as not representing observations of the fact.

An Oriental author.

After this, a most remarkable volume came in our way; a book printed privately in 1863 by "Hekekyan Bey,[1] C.E., of Constantinople, and formerly in the Egyptian service." It is entitled, on the "Chronology of the Siriadic Monuments," and contains both a large

[1] This author enjoys the following favourable introduction in Mr. T. Sopwith's *Notes on Egypt*, 1857:—"We next called on Hekekyan Bey, who occupies a spacious and handsome house in the same locality, near the north-west corner of the Place Eskebeeh. Hekekyan Bey spent some thirteen years in England in early life, and thus acquired a perfect knowledge of the language and institutions of that country; I greatly enjoyed his conversation, which embraced several subjects of national interest, and his general opinions and sentiments appeared to be those of an enlightened citizen of the world."

plate of the sectional interior of the Great Pyramid, and an allusion to the coffer, under the name of "the *King's Stone*[1] *deposited by the Arians in the sanctuary of the first Pyramid, as a record of their standard metric system.*" So far, as that the book shows an Eastern mind breaking through the tyrannical Western hypothesis of a "sarcophagus," it is well; but the method of deducing a value for the profane Nile cubit out of certain arbitrary proportions of both the outside and inside measures of the said "King's Stone," is clumsy in a scientific point of view, overlaid with masonic mysteries, and discloses no better knowledge of the real dimensions of the coffer, than those taken by Greaves 230 years ago; and without any of those necessary subsequent corrections for the length of his standard scale, or investigations of his large errors in its outside elements.

Hekekyan Bey, on the Coffer and cubit.

Has no exact, or new, information as to measure.

Free-masonry, in fact, notwithstanding all its boastings, seemed to lead no nearer to a knowledge of the objects and ideas of the coffer, than anything connected with the idolatrous religion of the ancient Egyptians; and to all that side of the world there has ever been an

Free-masonry, and profane Egypt, both at fault.

[1] Early writers were particular in notifying that the coffer was cut out of a single block of stone; but this present name is a more peculiar designation of it, and may indicate a tradition of its having something of a special hidden virtue, recalling the fabled "philosopher's stone."

impenetrable darkness touching the real nature of the Great Pyramid. What that is, as the earlier chapters of our book must have tended to attest, its component portions have begun to yield up now, when the appointed time has almost come, and when good, honest, truthful science, as prosecuted by Christian men, has become highly developed in the world, and capable of being used in important inquiries.

Superior hopes from science pursued on Christian principles.

Had not all European countries made the splendid efforts which they have done during the last hundred and fifty years, in the promotion of geodesic science, the terrestrial reference and extraordinary value of the Pyramid standard of linear measure would not have been perceived. In an earlier age of the world it would have been of no use for a Colonel Howard-Vyse to have uncovered the two last of the casing-stones, for men were not then prepared to appreciate their refined and abstract value; neither were they able to perceive the far-reaching characteristics embodied in the construction of the porphyry coffer. That vessel of exquisite meaning they had in their hands, even as it was, too soon; and therefore they have despised, banged, and broken it during successive ages, and even in the present day, to such a degree, that, as Sir Gardner Wilkinson writes in Murray's *Handbook*, "it will soon

The time and season for discovery of Pyramid's objects, only lately arrived, or now arriving.

become a mere fragment, if visitors continue their depredations for a few years more at the present rate." The opportunity is therefore now gone from the world for ever, to solve by fresh scientific investigation, at the place, the chief mystery and boon to the human race which the Great Pyramid was built to enshrine.

Blind and stupid destruction by men, of necessary data.

Yet even there we have been favoured beyond our deserts, for Greaves' accurate measures, more than two hundred years in advance of his time, still live to testify to what the coffer was in the days of its safety and entireness. And to these measures, as corrected by the French philosophers, who examined the marks which he had made on the wall of the King's Chamber, immediately after he had taken those remarkable measures of the interior of the coffer, and which he recorded with all the precautions of Ulugh Bey himself,—we must now trust entirely.

The hopes of the world obliged to rest on Prof. Greaves' observations in 1638.

On entering the last low door that leads into the King's chamber, there are to be noted over it, says Greaves, "five lines cut parallel and perpendicular, in the manner described in (his) Plate II. Besides these I have not observed any other sculptures or engravings in the whole Pyramid."[1]

The five lines over the doorway.

[1] See Mr. Taylor's *Great Pyramid*, p. 109; also see Greaves' plate, where the lines are five in number, distinct and clear, and not coming down to the actual edge of the door.

The ante-chamber, to the Coffer's room.

When the spectator sees the lines, he must already, in order to come within view of them, have bent him low and humbly to enter the first small door leading out of the grand gallery; and he must be standing at the moment in the midst of the extraordinary furnishing, or granite trappings, of the outer chamber.

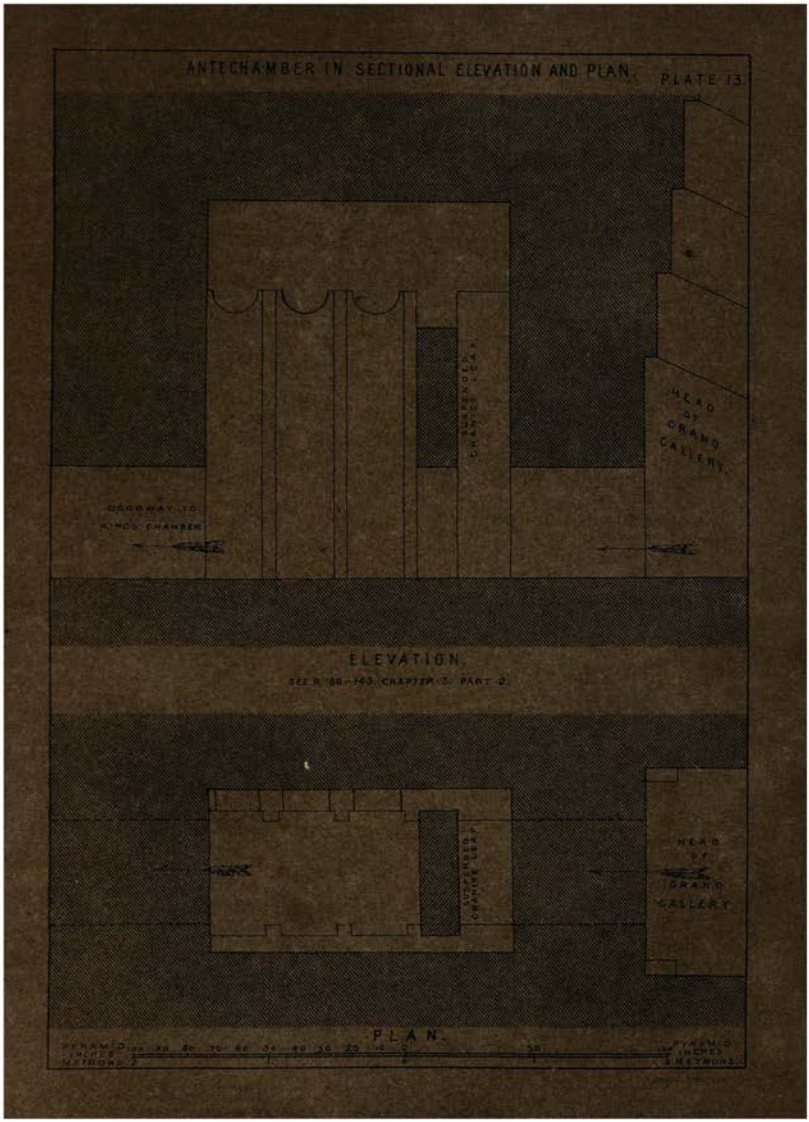
Furnishings of the ante-chamber.

These have never been fully explained, and are mainly as follows: on either side are opposite sets of broad hollow grooves; three being very broad ones,[1] and one moderately broad; the latter, through a part of its height, is occupied by a granite block or plate, which hangs suspended in it, and underneath which every one must pass. This fourth groove is also, it should be duly noted, removed a very notable distance from its own end of the room. (See Plate XIII.)

Of their interpretation.

Look on these things, O visitor; and think, before you bend again under the last door, and behold, in its solitary state at the farther end of the royal chamber, the ultimate coffer itself. Throw away from thee now all reminiscence of profane Egypt and the desires of her idolatrous heart, for there is not a shadow of a hieroglyphic on either the coffer or walls round about. Think not of her measures, which are "the cubit of a

1 "Ces trois travées singulières qui précèdent la chambre centrale, leur forme et leurs détails sans analogie avec rien de ce que l'on connait."—M. Jomard in *Description de l'Egypte.*


ANTECHAMBER IN SECTIONAL ELEVATION AND PLAN.
PLATE 13.
DOORWAY TO KING'S CHAMBER
SUSPENDED GRANITE BEAM
HEAD OF GRAND GALLERY
ELEVATION.
SEE P. 88-143. CHAPTER 5. PART 2.
SUSPENDED GRANITE BEAM
HEAD OF GRAND GALLERY
PLAN.
PYRAMID INCHES
METRONS
PYRAMID INCHES
METRONS

man" and nothing more; but, on looking up at those five vertical parallel lines,[1] be reminded thereby of the standard of length of the Pyramid itself, 50 inches, each of these inches being the $\frac{1}{500,000,000}$th part of the earth's axis of rotation; than which nothing better or more thoroughly scientific is possible for a standard of linear measure.

Hieroglyphics nowhere; and not to be thought of.

Then, behold, these three broad empty grooves; they surely speak of the three dimensions of a vessel of *capacity*. Cube, therefore, the 50 inches; making them 125,000. Observe, however, that these grooves are rounded at the top, and that they are hampered by the granite-filled space at their side. (See Plate XIII.)

Of the side grooves of the ante-chamber.

Well! much, very much, depends on this; and we are most anxious to instantly lay the nature of the results before the indulgent reader; but are rudely

[1] We had thought of these and followed out the ideas which they gave rise to, before coming on the French pictures of them, which make their number *four* only, and extending from the ceiling right down to the doorway edge itself. And really what feature soever is there not in the Pyramid, which, though put in by its ancient builders with breadth, purity, and firmness, we do not find modern authors contradicting each other flatly about. We have traced up this case since then in several writers, and got more testimony on either side, but with this general result,—one party says that there are five lines of circumscribed length in the middle of a large flat surface; and the other says, that this large flat surface is coursed through and through by four long lines; but as in this case the said flat surface is divided into five portions, and by the French engraving, equal portions,—it is a matter of indifference to our view, which party is eventually found to be right.

Contradictions of travellers.

assaulted once more by the ever-accompanying necessity in this inquiry, of proving that these things do exist in the Pyramid, as some travellers have described them.

A necessity for every theorist on the Great Pyramid.

Go where we may about the Great Pyramid, this necessity ever follows, like black care behind the horseman; and the following are the contradictions which it would just now have us dispose of, before venturing to found any suggestions on things, which, if they be not facts, what will the worth of the suggestions be?

Of the semicircular hollows at top of three grooves.

Touching the rounding of the three groove tops for instance, some authors say that it exists only on the western, and not on the eastern, side of the room, while others relate that it obtains on *either* side.

Professor Greaves is of this number in his letterpress, but in his drawing he gives only one set, and these are curiously taken out and away from what they belong to at the side; and are set, probably for the copperplate engraver's convenience, over the five lines above the doorway. But whether there be one set, or two sets, of the three hollows, does not matter much to our position: though, in either case, it leaves a mystery unexplained by those persons who consider the whole ante-chamber merely as a "portcullis" arrangement, to close the entrance to the King's chamber.

This party includes some excellent names, as those of

Sir Gardner Wilkinson and Colonel Howard-Vyse; and they speak confidently of *three*, or sometimes *four* portcullises; *i. e.*, as many portcullis-blocks as there are broad hollow grooves. Of the *portcullis* theory of the antechamber.

It is to be objected, however, to their theories,—

1*st*, That there is no testimony to the three broader grooves (with the cup-shaped hollows at the top) having ever been occupied by portcullis-blocks at all.

2*d*, While there *is* a block in the fourth groove, there is no testimony to its ever having been let down or made to act as a portcullis. Objections thereto.

3*d*, Even if it had been let down, it would not have made a *good* portcullis; because, A, it is but a mere sheet of stone; Professor Greaves compares it to the "leaf of a sluice;" and B, it is at such a distance from the doorway which it has to close against all comers, viz., 21 inches, that a lithe wiry man would clamber in under the door, and in and between it, and over this mere moderate obstacle, with the greatest ease. And Practical insufficiency of such a portcullis.

4*th*, No one looked on the arrangement as a portcullis, until that theory had been started by inventive Western minds. Previously, one author had described the ribs between the unoccupied hollow grooves as "pilasters;" and had been corrected by another, who was sure that pilasters had no such antiquity as the

Professor Greaves' impression of the ante-chamber, and suspended granite block.

Pyramid. Professor Greaves, too, had the impression given to him, not that the place either was, or was intended to be, filled up with solid blocks, but that it was purposely left open, or empty; and he speaks of what we denominate the ante-chamber, as "two ante-closets;" he looking at the thin "leaf" of suspended stone crossing the room (and not at either end) as an intended division of the one chamber into two; and he describes confidently "the inner" and "the outer" ante-closet, whose only separation from each other was that leaf of "red-speckled stone, hanging more than three feet above the floor, and wanting two of the roof." And to this evident insufficiency of the ante-chamber arrangements to act as a portcullis, we may add this powerful argument, that when a portcullis *was* wanted in the Great Pyramid, its builders could, and did, make something extraordinarily effective; witness that one which has never yet been lifted, or passed over (as the ante-chamber leaf could so easily be, if let down), at the commencement of the ascending passage. We have not been able to meet with any drawing of the machinery of that portcullis, but the following sketch from Colonel Howard-Vyse, describing a similar apparatus in another Pyramid, will commend itself to a practical mind; and so far as mere workmanship goes, irrespective of ulti-

Real granite portcullis by Pyramid builders.

Plate of a granite portcullis.

PLATE 14.

P.143. CH. 3. PART 2.

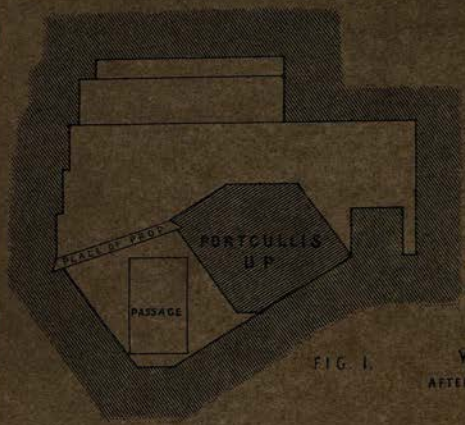


FIG. 1.

GRANITE PORTCULLIS.

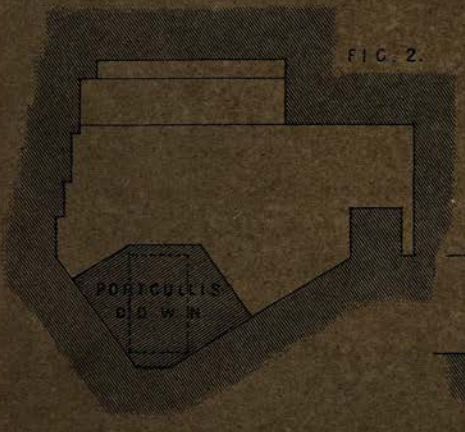
IN SOUTHERN STONE PYRAMID OF DASHOOR.

VERTICAL SECTIONS

AFTER COL. HOWARD VYSE AND J. S. PERRING

FIG. 3.

FIG. 2.



PYRAMID 100 INCHES. 50 0 100 200 PYRAMID INCHES.

mate objects, it is allowable so to refer to Egyptian example. (See Plate XIV.)

Existence of facts of ante-chamber.

Surely then, we may now take up the thread of our argument again, and refer with security to the three broad empty grooves of the ante-chamber, rounded at the top, as facts, and also as having been intended to be empty; and to the one groove by their side holding a granite block, as something else than a simple portcullis.

It is only at the top, too, that the hollow channels are rounded; and the granite filled space is not so broad as either of the three empty grooves; neither one nor other of those features, therefore, completely controls the three grand spaces or grooves themselves, though they both simultaneously influence them.

Possible reference to earth's figure, and weight.

Is it barely possible then, that one of those things is a reminder of the spherical figure of the world, and the other of its density? This latter idea is even assisted by the five chambers of construction over the King's chamber (five chambers and the fifth more than half as large again as the others), constructed of course firstly for another reason, but perhaps symbolical of something else as well.

If, then, we reduce that cube quantity of 125,000 to a sphere of the diameter of 50 inches, we get five places of numbers, but they are in figures too small to repre-

sent the coffer. And if, on the other hand, we multiply 125,000 by 5·672, or the best modern determination of the density of the earth,—we get the right sizes of figures, but one place of numbers too much.

Mode of applying the spherical figure, and mean density, to linear standard cubed.

Take, therefore, the five places of numbers as due to the spherical shape of the earth, but put therein the actual figures, so far as given by the cube of the linear standard of the Pyramid when multiplied into the earth's mean density,—and then we have as the theoretical determination of the cubical contents of the Great Pyramid's standard measure of capacity and weight,

70,900·0 Pyramid inches;

which, reduced to English inches, becomes

70,970·2.

Close result to measure of Coffer.

Now, the observed cubic contents of the coffer, as already deduced after all corrections, from Professor Greaves' observations

= 70,982·4 English inches.

Is it true?

Are we then to say that *this* is the reason of the Pyramid coffer having been made of the size which it is, viz., to give the Pyramid measure of capacity and weight a connexion with the capacity and mass, as well as with a single linear feature, of the earth?

Some further inquiry may be necessary.

CHAPTER IV.

DENSITY AND TEMPERATURE.

English measure, Coffer measure, and theoretical measure.

OF the three quantities which we have already obtained, each expressed in English cubic inches, viz. :—

70,982·1

for four English quarters ;

70,982·4

for Greaves' French corrected measure of the coffer ; and

70,970·2

as our theoretical conclusion of what the coffer ought to measure,—the first is, of course, as a set of figures, unassailable, because so constituted by the legal arithmetical proportion ; the second, there is not much doubt about, because Greaves' measures were so carefully taken, and the value of his standard so well, though perhaps not perfectly, ascertained by the French *savants* in 1799 ; but the third refers to a very peculiar phenomenon, and depends entirely for its correctness

The theoretical measure depends, on *Mean density of Earth.*

on our knowledge of the *mean density of the earth.* Now this quantity, notwithstanding that it has been at all times a subject of permanent interest throughout many of the most important and varied branches of Natural Philosophy, even besides the purely astronomical, and not only in this country, but the whole world over,—yet it has been practically, or successfully, studied by hardly any other nation than ourselves; and what we have done in the cause, has been confined to very late times indeed.

Earliest attempt to measure Earth's mean density.

The first special move, always excepting Sir Isaac Newton's most sagacious guess in the absence of any experiment,[1] seems to have been made by Dr. Maskelyne in 1772; who wrote as follows to the Royal Society of London, in the course of a paper urging the propriety of making experiments, to measure the precise angle through which a pendulum might be drawn out of the vertical, by the attraction of a mountain mass.

"It will be easily acknowledged," wrote he, "that to find a sensible attraction of any hill, from undoubted

[1] Sir Isaac's words are: "Unde cum terra communis suprema quasi duplo gravior sit quam aquâ, et paulo inferius in fodinis quasi triplo vel quadruplo aut etiam quintuplo gravior reperiatur; verisimile est quod copia materiæ totius in terrâ quasi quintuplo vel sextuplo major sit quam si tota ex aquâ constaret." A rudely correct approach this, to the density of the whole earth; but by means of such a decided over-estimate of the mean density of the average materials of "mines or quarries," that it did not carry much conviction with it.

experiment, would be a matter of no small curiosity, would greatly illustrate the theory of gravity, and would make the universal gravitation of matter, as it were, palpable to every person, and fit to convince those who will yield their assent to nothing but downright experiment. Nor would its uses end here, for it would serve to give us a better idea of the total mass of the earth, and the proportional density of the matter near the surface, compared with the mean density of the whole earth. The result of such an uncommon experiment, which I should hope would prove successful, would doubtless do honour to the nation where it was made, and the society which executed it."

Dr. Maskelyne's recommendation of the subject.

The effect of this representation was, that the Society did undertake the experiment; Mount Schihallion in Perthshire (Scotland) was selected as the most appropriate site, Dr. Maskelyne being appointed to make the observations, and Dr. Hutton to calculate the results; which were reported, in 1778, to be,—that the mean density of the whole earth was = 4·5; that is, composed of matter $4\frac{1}{2}$ times heavier than water.

The Schihallion experiment.

This result rather surprised most men at the time, for "common stone," of which they had usually considered the majority of the earth to consist, was known to be only $2\frac{1}{2}$ times the density of water.

Mineralogy improves the Schihallion result.

They looked, therefore, into the composition of the Schihallion mountain itself, which they had vaguely, as a first approximation, considered to be of "common stone;" and Playfair, the Edinburgh Professor of Natural Philosophy, determined the specific gravity of its principal minerals to be from 2·64 to 2·81, in proportions that brought up the concluded density of the whole earth to 4·8; with some suspicions that it might be more.

In this the computers were apparently right, for every determination that has been made since then, by every method, has invariably given greater results. The only experiment quite similar, was that reported to the Royal Society in 1856 by Colonel Sir Henry James in charge of the Ordnance Survey, and describing the observations made with the Zenith Sector on the hill of "Arthur's Seat," near Edinburgh, which yielded 5·316.

Edinburgh "Arthur's Seat" result.

The Astronomer-Royal's *mine* experiments.

Another species of experiment, not far removed in its nature from the above, was tried in 1826 by Mr. Airy, the Astronomer-Royal for England, Dr. Whewell, and the Rev. Mr. Sheepshanks, by means of pendulum observations, at the top and bottom of a deep mine in Cornwall; but the method failed. Subsequently, in 1855, it was taken up again by Mr. Airy alone, in a mine near Newcastle, with rather better, though still

not slightly indifferent results,—the mean density of the earth coming out, 6·565.

The general conclusions from these researches have been, that the earth is so extremely far from being in practice a homogeneous solid, that it is rather a mistake to try a mean-density experiment either on a mountain mass, or, much more, in a mine; for though, as was the case in all these instances, the most unrivalled powers of instrumental observation and mathematical theory were brought to bear on them by the very able men concerned; yet the processes employed, tended only to blind their respective authors as to the real success which they were achieving on their ultimate end and aim respecting the whole earth; and, therefore, when at Arthur's Seat the probable error of the result there was computed at, ± 0·054; and at Harton Colliery at, ± 0·018, —it was not encouraging to find afterwards, on comparing the absolute determinations at either place, that they differed in their statement for one and the same thing, by so large an amount as 1·249.

Probable error of results thus obtained, very large.

Good service was, therefore, done to the world in the course of the last century, when the Rev. John Mitchell proposed a direct manner of trying the same experiment between the several parts of one and the same piece of apparatus. He died, indeed, before he himself could

Mitchell's instrumental method.

Method tried by Cavendish.

try his acute suggestion; but it was taken up after his death by the celebrated Cavendish, and worked very successfully in 1798, and with a result of 5·450. We say successfully, for he evidently made a great stride towards the truth; he improved the existing determination of his day to a large proportional quantity, and no part of the increase which he gave it, has had since to be removed.

What more than this, then, would any one desire or expect from any one man in his generation?

"Why," said certain very rigid philosophers, of more than human uprightness, "he ought to have made the experiment *perfectly;* he ought to *have set the question at rest.*"

We fear that such speeches do not show the highest appreciation of the infinity of Nature, and the rate or manner of development of the human mind; and not a great deal of charity, or justice, or common sense.

Repeated by Reich in Freyberg.

Nearly forty years after Cavendish's great work, his experiment was repeated by Professor Reich of Freyberg, in Saxony, with a result of 5·44; and then came the grand repetition by the late Francis Baily, representing therein the Royal Astronomical Society of London, and in fact the British Government, and the British nation.

With exquisite care did that well-versed and metho-

dical observer proceed to his task; and the attention of every man of mathematical science in the country was directed towards his operations. Much, indeed, and more than any one then thought, was depending on his labours; for without them the world's knowledge of the mean density of the earth, even up to this present time 1864, would not have been such as to warrant any interpretation of the Great Pyramid standards of weight and capacity.

Grander repetition by Francis Baily.

The skill of T. Bramah was first employed in casting an immense cylinder of lead, pure and dense; and then in producing from it, by the most exact turning in the lathe, two faultless spheres, each 12·1026 inches in diameter, and 380·469 lbs. avoir. in weight. These were for the *attracting* balls, to which Mr. Simms added, with all an optician's skill, the smaller balls to be attracted, and the niceties of the "torsion-suspension," by which the smallest attractive influence on them was to be made sensible.

Manufacture of the apparatus.

This apparatus was erected by Mr. Baily in an isolated room in the garden of his mansion in Tavistock Place,—and observations were soon begun with even more than official regularity.

Early trials of it.

But they did not prosper.

Week after week, and month after month, unceasing

Anomalies met with.

measures were recorded; but only to show that some disturbing element was at work, overpowering the attraction of the larger on the smaller balls.

What could it be?

Professor Reich was applied to, to say how he had contrived to get the much greater degree of accordance with each other, that his published observations showed.

Reich's experience of them.

"Ah!" he explained, "he had had to reject a large number of them, for extravagant inconsistencies; and he would not have had any presentable, unless he had guarded against variations of *temperature*, by putting the whole apparatus into a cellar, and only looking at it with a telescope through a small hole in the door."

Then it was remembered, that a very similar plan had been adopted by Cavendish; who had furthermore left this note behind him, for his successor's attention,

Cavendish's advice.

—that even still, or after all the precautions which he did take, minute variations and small exchanges of temperature between the large and small balls were the chief obstacle to full accuracy.

Followed by Baily, with additions.

Mr. Baily therefore adopted yet further means to prevent sudden changes of temperature in his observing-room; but as he could not prevent them absolutely, he profited by the advice of Professor J. D. Forbes, of placing gilded surfaces between the balls; for, though

gravitation will pass through anything, radiant heat has extraordinary difficulty in piercing a surface of polished gold.

Immediately that this plan was tried, the anomalies in the measures almost vanished; and then began the most full and complete series of observations of the effect of gravitation attraction, of one set of artificial globes on another, that has ever been made upon the earth.

Elimination of the disturbances.

The full story of them, and all the particulars of every numerical entry, and the whole of the steps of calculation, are to be found in the Memoirs of the Astronomical Society, and constitute one of the most interesting volumes[1] of that important series; besides affording a determination of the mean density of the earth, which will probably be looked on as the standard one, for the next hundred years at least.

Excellent result finally for Earth's mean density.

Now, this determination is generally quoted as 5·675; while the quantity which we have employed is

Of its precise numerical statement.

5·672.

What is the reason of this?

In the last page but one, of his invaluable Memoir, Mr. Baily does give the general mean of the whole of his observations, without exception, as 5·675; but he

[1] The Fourteenth Volume.

F. Baily's ideas on his own statement of the results.

mentions in the body of the paper, sundry reasons for concluding, that some of them are not so trustworthy as others; and finally he devotes the last page of all, to exhibiting—first, the exact mean of the whole, and then four successive means of the residual ones, when certain classes of observation have been rejected. He will not undertake himself to say, what the true deduction from everything should be, or how far the quantity first given as the mean of *all* the observations should be modified by a judgment of the circumstances of each; but while he evidently thinks that something should be done, in the way of giving a weight to each observation, in proportion to its reputed trustworthiness, he throws that task on each reader to execute for himself. This was rather an anomalous ridding *himself* of responsibility in his own work; but Mr. Baily pretty plainly believed, in the well-satisfied and calm-thinking depths of his own philosophic mind, that, within the limits by which even his highest mean quantity differed from his lowest, no person could go very far wrong.

His several means.

Now the quantities stand thus:—

Mean of all the observations $= 5{\cdot}6747$
Mean of the first selected set $= 5{\cdot}6754$
Mean of the second selected set $= 5{\cdot}6666$
Mean of the third selected set $= 5{\cdot}6683$, and
Mean of the fourth selected set $= 5{\cdot}6604$;

and it is pretty evident that we ought not to take so positively a one-sided view as, 5·675. *Some* weight ought to be allowed to the subsidiary quantities, though not much, and after some hesitation we have given the preference to 5·672.

If all our object had been to get a theoretical quantity to agree with the four English quarters, and Greaves' corrected measure of the coffer, there would have been no trouble in obtaining it precisely; for the upper limit of the density numbers gives more, and the lower limit less, than we want. But our object is of course to get at the truth in nature, of this very mysterious, but all important, quality of the substance of the earth on which we live; and though 5·673, would have given us a quantity for the coffer within a small fraction of an inch of the observed measure, we have preferred to assume, as before mentioned,

Quantity finally chosen, for Earth's true mean density.

5·672,

as more likely to be the true *mean density* of the earth.

With this quantity we have for the theoretical contents of the coffer, in Pyramid inches, 70,900, and in English inches, 70,970·2; making a difference from the *observed*-coffer quantity of 12·2 inches. This looks large at first, but on reflecting that it is upon the cubic contents of a goodly vessel, and that so slight a radical

Its application to the Coffer.

error in the value of Greaves' measuring-rod, as one-thousandth of an inch in a run of twenty inches, or $\frac{1}{20,000}$th of an inch on each inch, would explain it all,—any wonder at the magnitude of the error should rather change into admiration that it is not a great deal larger.

Final conclusion for contents of Coffer, as a vessel of capacity.

We elect then to take

70,970·2

English cubic inches as the true, because the theoretically proved, contents of the porphyry coffer; and therefore accept these numbers as giving the cubic size of the grand standard measure of *capacity* in the Great Pyramid.

Of the Coffer, as a vessel of weight.

So far so good, for that sort of measure; but now, how are we to procure an idea of its congener, viz., the standard measure of *weight* belonging to the Pyramid?

Determined by filling with water.

Measures of weight are most generally derived from measures of known capacity, by filling them with water; in early days it was enough to say, "fair spring water;" but in modern times, they say distilled water, and more particularly of a special *temperature;* this last is, in fact, the chief disturbing element.

That water was used, and intended to be used again, in the Great Pyramid, there is little doubt; the building itself had its own internal well whereby to reach

water, and water of acknowledged purity; while the shape of the coffer was precisely such as gave the idea of a *water-trough*. "Oh!" said the Indian Brahmin Priests, on hearing the King's Chamber and the mysterious coffer described to them by Mr. St. John, "that vessel was for holding sacred water; you may be sure too that there was some underground communication with the holy river, and the priests kept the vessel constantly full of its blessed water, and with lotus-flowers floating on its surface."

The Coffer's suitability for holding water.

Oh! by all means lotus-flowers! no doubt that was the mode in which Brahmin priests would have utilized the porphyry coffer, and the Pyramid too, had it been in their possession, and if they could have enlarged both its entrances and exits somewhat, to suit their teeming crowds of worshippers; and the coffer would have stood that sort of use extremely well, for, composed of such a flinty, diamond-texture, and fissureless mass of rock (as it is, and must be, to give out its bell-like note when cruelly struck with hammers and axes),[1] water would lie in it for ages harmless.

Often tested.

But the temperature, how about that? That is really more important than the affair of the water itself, because the temperature affects the size of the containing

1 See the practice of most travellers, as described by themselves.

vessel to begin with, as well as the density of the water wherewith it is to be filled! The Nile water distilled by nature on a world-wide scale from the great wilderness of the broad Southern Ocean, precipitated in endless torrents of wholesome rain under the Equator, conveyed in overpowering quantity year by year through all Egypt to the North, and then filtered from impurities in its passage underground to the Pyramid, must, as to its physical nature, be of a magnificently standard quality for the world at large, from age to age; and there are some sort of symptoms in the depressed floor of the so-called Queen's Chamber, that that may have been a storehouse for the purest water required for experimental purposes.

Character of the water supplied to the Coffer.

On this subject, of the Nile water, and whence it is derived,—which Europe has made mystical difficulties of for ages, and has only fully appreciated the sense of, on reading the rain-gauge journal of Captains Speke and Grant, in their recent adventurous journey and residence under the East African Equator, and its populated table-lands of moderate elevation,—some eminent good sense was published by Professor Greaves in 1638. He begins with Egypt's own supply of rain, also a much-vexed question:—

Speke and Grant's discovery of the sources of the Nile water.

"I cannot sufficiently wonder at the ancients, who

generally deny the fall of rain in Ægypt. Pomponius Mela in express terms relates that Ægypt is *terra expers imbrium, mirè tamen fertilis.* Whereas for two months, namely, December and January, I have not known it rain so constantly and with so much violence at London, as I found it to do at Alexandria, the winds continuing north-north-west; which caused me to keep a diary, as well of the weather, as I did of my observations in astronomy. And not only there, but also at Grand Cairo, my very noble and worthy friend, Sir William Paston, at the same time observed, that there fell much rain. But, it may be, the ancients mean the upper parts of Egypt beyond Thebes, about Syene, and near the Catadupæ or cataracts of Nilus, where I have been told by the Ægyptians, that it seldom rains. And, therefore, Seneca seems to have writ true: *In eâ parte, quæ in Æthiopiam vergit* (speaking of Ægypt), *aut nulli imbres sunt aut rari.* But where he after says, *Alexandriæ nives, non cadunt,* it is false;" (poor Seneca;) "for at my being there in January at night it snowed."

Professor Greaves on rain in Egypt.

In Upper Egypt.

"However, farther to the south than Ægypt, between the Tropicks, and near the Line, in Habassia or Æthiopia, every year for many weeks there falls store of rain, as the Habassines themselves at Grand Cairo

Beyond Egypt, and under the Equator.

relate. Which may be confirmed by Josephus Acosta, who observes, in Peru and some other places lying in the same parallel with those of Æthiopia, that they have abundance of rains."

Greaves' concluded cause for the Nile inundation.

"This, then, is the true cause of the inundation of Nilus in the summer time, being then highest, when other rivers are lowest; and not those which are alledged by Herodotus, Diodorus, Plutarch, Aristides, Heliodorus, and others, who are extremely troubled to give a reason for the inundation; imputing it either to the peculiar nature of the river, or to the obstruction of the mouth of it by the Etesiæ, or to the melting of snows in Æthiopia (which, I believe, seldom fall in those hot countries, where the natives by reason of the extreme heats are all black), or to some such other reasons of little weight."

A good reasoner on the subject in ancient times.

"In Diodorus I find Agatharchides Cnidius to give almost the same reason assigned by me; but those times gave little credit to his assertion. Yet Diodorus seems to assent to it," writing that "'*Agatharchides Cnidius hath come nearest to the truth; for he saith, every year in the mountains about Æthiopia, there are continual rains from the summer solstice to the autumnal æquinox, which cause the inundation.*'"

"The time of this is generally accounted so certain

that I have seen the Ægyptian astronomers to put it down many years before in their Ephemerides, that *such a day of such a month the Nilus begins to rise.*"

But still about the temperature: 4200 years ago was long before the day of mercurial thermometers; and the smallest alteration of temperature occurring in the course of the experiments, would have introduced unnumbered perplexities. Of the coffer's temperature.

This is perfect truth, and absolute fact; and the latest conclusions of the best geodesists, in conducting their modern standard-scale experiments, is expressed in the maxim, "have as little to do with *variations* of temperature as possible; it is an insidious element, whose actions and reactions men will hardly ever hear the last of." We have seen too, already, how this feature went close to the annihilation of the Cavendish experiment and its repetitions; and that the only source of safety was, not any attempt by power of modern mathematics to compute the disturbing effect, and so eliminate it; but, to cut down the variations of temperature themselves. *Variations* of temperature always to be guarded against.

Hence that retreating into cellars, and closing of doors, and only looking in through small holes with telescopes. Quite similarly, in every astronomical Observatory, where uniformity of clock-rate is prized,

it has been found, that after the clockmaker has done everything which art can do, in decreasing the disturbing effects of change of temperature, by a so-called, and in truth very considerably effective "temperature compensation pendulum," there is always a further improvement that can be effected in the going of the clock, by superadding contrivances to lessen the amount of the heat-changes themselves.

Principle exhibited in astronomical clocks.

Thus, at the great Observatory of Pulkova, near St. Petersburg, where they value a power over small fractions of a second, perhaps more than anywhere else in the wide world, the very able Russian astronomers erected the chief clock of their establishment in the central hall of that building, in which no window was ever opened, and large masses of masonry on every side greatly promoted an equality of temperature both by day and by night. And their clock was thereby found to keep a much better rate, than a similarly constructed clock (with a so-called-by-the-clockmakers "temperature compensated pendulum" of course) placed in one of the astronomical observing-rooms, where the opening of the shutters in the roof for observing the stars, admitted air sometimes warm and sometimes cold.

Instance at the Pulkova Observatory.

But within the course of only the present year, we have been informed by M. Wagner, in charge of the

time observations at Pulkova under M. Otto Struve, that their normal clock is going now more uniformly than it has ever done before, or than they believe any other clock in the world is going; and because, from the ground-floor of the building, they have removed it, the clock, to the "subterraneans" of the Observatory, where the natural changes of temperature are smaller still. Recent improvement at Pulkova.

It is not, however, quite certain yet, that theirs is the best-going clock in existence, for M. Le Verrier has recently removed the normal clock of the Paris Imperial Observatory to the "Caves," which exist there underground at a depth of 95 feet below the surface; and in a triumphant manner he remarked, when mentioning the case to us, "*température invariable, constant.*" Improvements also at the Paris Observatory.

Now, at the Edinburgh Royal Observatory, there have been observations taken for many years of several large and very long-stemmed thermometers, whose bulbs have been let into the rock at various measured depths; and it is found that, notwithstanding the possibly-disturbing effect of rain-water soaking down through fissures, there is such an astonishing power in a mass of stony matter to decrease temperature-variations, that, at the surface of the ground, the Observations at the Edinburgh Royal Observatory.

Mean semi-annual variation of heat amounts to	= 50° Fahr.
At 3 inches under the surface, .	= 30°
At 3 feet, ...	= 16°
At 6 feet, ...	= 10°
At 12 feet, ...	= 5°
At 24 feet, ...	= 1°

At 95 feet, then, from the surface, in the case of the Paris Observatory, how very slight and innocuous to the most refined observation, must be the variation of season-temperature! But how much more slightly affected still, and how admirably suited to a scientific observing-room, must not the King's Chamber in the Great Pyramid be, seeing that it is shielded from the outside summer heat and winter cold, by a thickness of nowhere less than 180 feet of solid masonry!

All modern Observatory principles and practice excelled by the Great Pyramid.

There is not, in truth, in any country of Europe, there never has been erected, and it does not look much as if there ever will be erected, by any nation under the sun, a scientific observing-room that can at all compare in the very leading requisite for such a room, with the King's Chamber of the Great Pyramid.

The King's Chamber an unexceptionable observing-room for some branches of physics.

When Francis Baily closed those remarkable observations of his on the "*mean density* of the earth," he predicted that they were not likely to be repeated again for fifty or a hundred years at least, or until the slow progress of science in general, and an improved know-

ledge of the theory of the "torsion pendulum," in particular, should have given the men of the day some reasonable hope of securing, by renewed experiment, a sensibly more accurate result. But had he been aware of the qualifications of that central chamber of the Great Pyramid, where too the mean density of the earth is so accurately personified in the Porphyry Coffer, he would have been off the very next week to repeat his experiments there; and to have seen, before he died, that mysterious and almost natural temple of the south.

How important to F. Baily in earth-density experiments.

All the science, then, of the present day, cannot improve on, and cannot too much commend, the *uniformity* arrangements for the temperature of the Pyramid coffer chamber; but then, to come to what is required in practice to know, over and above the mere fact of uniformity,—What is the absolute height, or degree, of the temperature itself?

Pyramid inside temperature; proved to be always very steady; but what is its degree?

There, unfortunately, we lack any high-class modern observations; but, so far as what are known, may be trusted, they point to a particular degree, which speaks extraordinarily of plan and intention. In the Pyramid, as before observed, there is a grand tendency for things and principles going by "fives;" and this seems carried out even in its temperature, being a temperature of

one-fifth; that is, one-fifth the distance between the freezing and boiling points of water above the former.

French observations of temperature.

The grounds for this belief are, that M. Jomard, in the *Description de l'Egypte*, gives the observed temperature of the King's Chamber part of the Pyramid, as 22° Cent.; but this was unnaturally raised by, 1*st*, the number of men with torches whom he had with him; 2*d*, by the incredible number of large bats which then made certain parts of the Pyramid their home; 3*d*, by the ventilating channels not being open or known in his day; and, 4*th*, by there not being that due mixture of vapour of water with the air, which would have resulted had the lower, and true, well been cleared out to the level of the Nile, remaining always as an open water-well in the heart of the Pyramid. Herodotus has a pretty fable about the tomb of King Cheops being situated at the bottom of this well, and some men, forsooth, would therefore dig for it, expecting to find worldly treasure, gold and silver, and precious stones. Well! let them dig, for if they only go deep enough, they will infallibly come on a jewel of inestimable price for scientific research.[1]

Corrections to normal state of Pyramid.

[1] "I have already mentioned that these buildings (the Jizeh Pyramids) appear to have been begun from the east, and likewise that all the sepulchral chambers are formed in the rock; and that, notwithstanding their enormous extent, the superstructures are almost entirely solid masses, excepting in the Great Pyramid, where the tomb is in the masonry,

Jomard's observed temperature *must* therefore have been too high; and when we read that he found the temperature of the Joseph Well in the citadel of Cairo 17° or 18° Cent., we come inevitably to the conclusion, that 20° would have more truly represented the natural temperature of the King's Chamber of the Pyramid under the intended normal circumstances of its foundation; and 20° Cent., or 68° Fahr., is precisely the temperature of one-fifth.

Temperature of 68° Fahr. most probable.

We may next conclude, that the temperature was the same 4200 years ago as now, because M. Arago has had the credit of having proved for the neighbouring land of Palestine an unchanged mean temperature for the same period, as illustrated by the continued coincident growth there of the vine and the date-palm; the vine to show that it had not ascended above one certain degree; and the date-palm to show that it had not fallen below another.

Mean temperature of the region constant.

although it has been distinctly stated by Herodotus to have been a subterraneous chamber of a peculiar description. I have, however, sufficiently alluded to this subject, and to our unsuccessful attempts in search of it. The historian is correct in many other instances, and it is certain that great precautions were taken to conceal the position of the sarcophagi. Doubts may therefore be entertained whether the real tombs have been discovered in the two larger pyramids, and the truth might be known respecting the one in question by the removal of the sand, and of the ground beneath it, to a level with the Nile, along the foot of the mountain upon which the Pyramid is placed; by which operation any canal for the conveyance of water would inevitably be discovered."—HOWARD-VYSE, *Pyramids of Jizeh*, vol. ii. p. 104.

Temperature of King's Chamber, lower than that of the ground near the Pyramid.

There is more, too, in the numbers resulting for the Pyramid, than the mere accident of the mean temperature of its particular parallel of latitude; for that would in truth seem to be rather higher, if observed at, or in, the ground itself, than this pyramidal quantity of one-fifth. At all events, M. Jomard made it so, (viz., 25° Cent.,) for the lower part of the "well" of the Pyramid; and also for several of the tombs in the open plain in the neighbourhood; and our Edinburgh earth-observations show, that a regular increase in temperature accompanies depth, even at the smallest distances below the surface of the ground. So that the mean temperature

At 6 feet is higher than at 3 feet below, by 0·3° Fahr.;
At 12 feet is higher than at 6 feet below, by 0·4° Fahr.; and
At 24 feet is higher than at 12 feet below, by 0·3° Fahr.

Accordant with Edinburgh observations.

Now, the King's Chamber is at a height of 140 feet above the level soil outside; and if the law of increase of internal earth-temperature is similar in the Pyramid mass (which too, is, for about one-seventh[1] of its height inside, the original rock of its hill) to the rocky Calton Hill, Edinburgh, there ought to be nearly the difference actually observed, between the degree for said King's Chamber and the lower part of the dry well.

[1] Sir Gardner Wilkinson, in Murray's *Handbook for Egypt*. Colonel Howard-Vyse, however, makes it only about one-twentieth.

Hence, although *uniformity* of temperature might have been equally secured by sinking the King's Chamber 150 feet or more, under the soil,—there would not then have been that desired temperature of one-fifth, but something much higher; and there might also have been, at such a depth, rather *too much* water. The place, indeed, would have been in danger of getting water-logged; but as it, the King's Chamber, now is, or would be exactly were the water-well re-opened, that remarkable room finds itself always at a temperature close upon 68° Fahr. (50° of the Pyramid scale); and admirably dry; for even if suddenly flooded with water by an accident, the water would rapidly drain itself off, by the notable angle of descent at which the large gallery leaves it.

The King's Chamber temperature, procured by design and intention.

To this subject, however, some further interesting developments may recall us on a future occasion. At present we may rest satisfied, that for practical purposes, the Pyramid measure of capacity, is kept at an invariable temperature, and therefore constant size; and that that temperature is very nearly 68° Fahr.

As then the coffer contains 70,970·2 English cubic inches of space; and each English cubic inch is declared by Act of Parliament (based on scientific measure) to weigh, at a temperature of 62° Fahr., and a barometric

Weight of coffer full of water.

Reduction of weight to Pyramid temperature.

pressure of 30 inches (nearly the constant pressure in Egypt), 252·458 English grains; the whole coffer would contain of water at that temperature, 17,917,000 grains; and that reduced for the expansion of water from 62° to 68° makes, 17,905,500 English grains.

This then forms the whole weight of the Pyramid grand standard of weight-measure; and we have now to see, what sort of system of smaller weights and measures for social purposes, the several Pyramid standards, of each kind, are capable of affording.

PART III.

NATIONAL WEIGHTS AND MEASURES.

CHAPTER I.—BRITISH METROLOGY, AND THE GOVERNMENT OF GREAT BRITAIN.

Early efforts to promote uniformity in British Metrology.

WHEN Magna Charta ruled the land,—and perhaps, in spirit, that was only during the interval between the framing and signing of the important document,—a ray of wisdom and a beam of light from some far-off horizon in the history of the human race, shot athwart the troubled scene of national weights and measures.

The Charter said that there was to be only one standard of weight and one standard of measure throughout the land;[1] and, to render that principle a possible one to carry out in practice, wisdom counselled, that standards of measure and of weight should be constructed,

[1] "Measures are wanted for two distinct objects, the commercial and the scientific. The wants of Natural Philosophy have grown up within the last two centuries; while so early as Magna Charta it was one of the concessions to the grievances of the subject that there should be one weight and one measure throughout the land."—*Penny Cyclopædia.*

and copies thereof despatched to all parts of the kingdom.

But what followed?

Intentions of Magna Charta defeated.

Why, what too uniformly follows when a generous people, roused for a time to the care and defence of their rights, trust all to the word of an unwilling sovereign, and then relax once more into passive obedience and dull routine.

The standard measures, if ever made, were lost, and no copies were sent to country districts; and then came a certain very natural consequence.

Weights and measures primarily appertain to the poor and the working men.

Practical weights and measures are primarily affairs of the working classes; of the poor, and those who with their own hands do the daily work of the world; not of the rich, who lazily drink in the mere fruits and quintessence thereof without toil to themselves. They, *i.e.*, the rich, and even the classes between them and the workers, viz., mercantile men, can perfectly well afford, in their comfortable counting-houses, to reckon up their gains in terms of any measures whatever under the sun, when balancing their books at stated intervals; but the working poor have neither the education, nor the time, nor the opportunity, to deal with more than one set of measures; and *they* must be such as come almost naturally.

In fact, they must come to a great extent quite natur-

ally; for who is there, unless experienced in practical matters himself, who knows how suddenly and immediately, in the daily affairs of working life, an unexpected exigency occurs; when, without books, or scales, or balances, or compasses, the labouring man has to look some natural danger in the face; and his only hope of plucking the flower, "safety," from the event, is in his then and there instantly concluding, without instrumental assistance, upon a correct, or nearly a correct, estimate of some measure of weight, or length of space, or bulk of material?

The standards should suit their requirements and circumstances.

The working man, too, *must* have measures to refer to at certain times. So what was the consequence when the restored King and Government, having got the rule of the country and the sweets of office once again into their power, did *not* send the promised standards to every town and every village in the land? Why, every town and every village began to make standard measures for themselves, and for their own immediate knots of working men.

Origin of much of the present diversity.

Then began the confusion worse confounded that has reigned in our national weights and measures ever since. Under the same name, at the same epoch, all sorts of different quantities have been intended in different parts of the country; and, in different parts

of the country, through a long series of years, what astounding names have not been invented!

Examples of diversity of weights and measures in the country.

The late Dr. Young collected almost as many as would have filled a small dictionary,[1] and the general progress of the nation was not at that time found improving to the matter. For, as civilisation progressed, wealth asserted its interests too powerfully for the poor; while law and moral philosophy got the better of plain practical science, and served the behests of wealth grovellingly.

Unequal bearing of legislation.

Whatever a rich man wants done, he can always get clever lawyers, even the first of their day, to help him to do; and lawyers were obtained in shoals to frame any number of Acts of Parliament to inflict pains and penalties on the poor, or to draw rent and taxes from them in any and every denomination, but to prevent their deriving profits unless a Statute standard was rigidly kept to.

That, to a certain extent, sounded well enough; but

[1] The following is an example from one division of his report:—Awm, bag, bale, basket, bat, bag, beatment, billet, bind, bing, boll, bolt, bolting, bottle, bout, box, bucket, bunch, bundle, burden, cabot, cade, canter, caroteel, carriage, cart, cartload, case, cast, cheef, chest, clue, cord, corf, cran, cranock, cut, cyvar, cyvelin, daugh, dish, drop, duffer, etc. etc.

"Mr. Adderley said that in his county there were thirty-six different bushels, and he was informed that in Lancashire there were more than double that number."—*Report of Discussion in the House of Commons, 14th May* 1864.

unfortunately, the powers that were, went on framing their Acts of Parliament without either defining, or identifying, any such standard. The taking of scientific steps really to do that, seemed to men of the pen, the law, and philosophy of mind a mere mechanical operation, which their ethereal studies placed them far above the level of. It was a drudgery they would not submit to; and even up to the other day (1814), when at last it was impressed on the governing bodies that, in the material matter of weights and measures, there must be material standards,—they appointed a yard, which was to bear a certain proportion to a seconds-pendulum of a special scientific order; but what length that pendulum was of, they did not inquire; for they said, "any expert watchmaker" could do that; and yet up to the present time neither watchmaker nor philosopher nor government official of any kind or degree has fully succeeded in that little problem.

Practical operations unjustly contemned.

So the confusion of weights and measures only grew and grew worse in the kingdom. About the year 1700 A.D., the Government, through the Attorney-General, instituted an accusation against a merchant for cheating the revenue by using false gallons, and he, the merchant, successfully proved that it was the Government's own appointed gallon that he had followed, and that

Unhappy consequences.

they did not know what they had been legislating on the subject.[1]

The fault thrown on the poor working men.

That was a grievous exposure, but of course the fault was thrown on the poor working men; and a Parliamentary committee reported in 1758, that of those unhappy, down-trodden, beings, "few were able heretofore to make proper measures or weights; standards were made and destroyed as defective, that others no less so might supply their places; and the unskilfulness of the artificers, joined to the ignorance of those who were to size and check the weights and measures in use, occasioned a great number of different measures to be dispersed through the kingdom, which were all deemed legal, yet disagreed.

[1] "A little after 1700 an information was tried in the Exchequer against one Baxter, for having imported more Alicant wine than he had paid duty for. On the part of the Crown it was contended that the sealed gallon at Guildhall (said to contain 231 cubic inches) was the standard. But the defendant appealed to the law, which required that a standard gallon should be kept at the Treasury; proved that there was such a gallon at the Treasury, containing 282 cubic inches; and established, by the evidence of the oldest persons in the trade, that the butts and hogsheads which came from Spain had always contained the proper number of the real standard gallons. A juror was withdrawn, and the law officers of the Crown took no further proceedings except procuring the above Act ('an Act of 5 Anne, cap. 27, for arresting the further decrease of the gallon below 231 inches'). A better instance of confusion could hardly be imagined; the legal gallon had gradually been diminished more than 50 cubic inches; the merchants in one particular trade continued to import and to pay duty by the real gallon, and were finally called to account by the Attorney-General, who, in common with the rest of the world, had forgotten what the real gallon was, and sued for penalties upon appeal to what was no more a legal standard than the measure in a private shop."—*Penny Cyclopædia.*

Case of Government confusion.

Other independent-minded persons, however, reported, and perhaps more justly, that another cause of this confusion was, "the prodigious number of Acts of Parliament, whereby the knowledge of weights and measures became every year more and more mysterious." In 1823 it was stated by Dr. Kelly, in his examination before the House of Lords, "that there had been upwards of two hundred laws enacted without success in favour of conformity, and five hundred *various* measures in defiance of those laws."

Other persons attribute the fault to the legislators.

But, in 1824, a standard yard and a standard pound were at last deposited in the House of Commons; and the Legislature enjoyed the advantage of having a moderately accurate example before them, of the practical thing they were legislating about. This pleasure, however, only lasted about ten years; for, in October 1834, both yard and pound perished in the great fire which consumed the two Houses of Parliament.

Short life of first Parliamentary Standard.

Then was made another attempt to get on without any standards at all; to collect revenue by the threat of a standard, and yet have no standard to refer to. Lawyers, therefore, had it all their own way; and in an Act of Parliament (5 and 6 William IV. c. 63), which passed both Assemblies in the following year, "the

Recurrence to false principles of legislation.

standards were referred to as if still in existence, and quoted as authorities to be appealed to on every occasion, although they had been actually destroyed a twelvemonth before, and no other standards substituted in their stead."

Legislating for Standards which had no existence.

Both Houses of Parliament certainly *appeared* to have been wholly ignorant of this actual non-existence of the objects on which they were legislating. But some persons said for them, that they were not, and never had been, entirely dependent on the legalized Parliamentary standards; for Government had an ancient standard of its own, to which ministers might refer whenever there was grave occasion.

Old Government Standards at the Exchequer.

Curiosity was excited. There had been indeed once two standards of length in the Exchequer, descended from somewhat historical times (*i.e.* Queen Elizabeth's); one of 45 inches, the other of 36. The former, the more accurate of the two, seems to have been allowed to drop out of sight altogether at some period unknown; and the latter was abused, instead of used, in a degree proportionate in latter days to the nation's advance in wealth, the growth of geodesic science amongst learned men, and the increase of general attention to the scientific subject of standards in foreign countries.

For, so far back as 1742, when some inquiries were

set on foot by the Royal Society of London, and the Paris Academy of Sciences,—the Exchequer standards were then in a respectable condition, and seemed to be treated with attention and care, by the high officers and clerks of the establishment. But no one had heard of them again for a long interval; and when their habitation was at length revisited in 1835, to see the foundation on which the government of King William was then legislating,—Mr. Baily reports of the then single standard, and apparently the only one,[1] "that it was impossible to speak of it too much in derision and contempt. A common kitchen poker, filed at the end in the rudest manner by the most bungling workman, would make as good a standard. It has been broken asunder," he writes, "and the two pieces have been dovetailed together; but so badly that

State of the linear standard, described by F. Baily.

[1] Since the above was written, an unusually good Parliamentary report has appeared, drawn up by Mr. Chisholm, Chief Clerk in the Office of the Comptroller-General of the Exchequer, on "The Exchequer Standards of Weight and Measure;" mentioning a yard rod, a gallon, and two bushels of Henry VII.; a yard measure and an ell, together with pints, quarts, gallons, bushels, and troy and avoirdupois weights of Queen Elizabeth, besides several other weights and measures of the time of the early Norman Kings, and not regarded as standards.

Exchequer Standards, reported on by H. W. Chisholm.

Of the above Exchequer standards, the yard rod of Henry VII. is that which was expressly stated, in 1743, to have been for a long time disused as a standard; the ell rod of Queen Elizabeth is that which also dropped into disuse between 1743 and 1835, while the yard rod of the same Queen is that which was reported on by Mr. Baily to the Royal Astronomical Society in 1835, with its length shortened by a dovetail.

F. Baily on the Exchequer linear standard.

the joint is nearly as loose as a pair of tongs. The date of the fracture I could not ascertain, it having occurred beyond the memory or knowledge of any of the officers at the Exchequer. And yet, till within the last ten years, to the disgrace of this country, copies of this measure have been circulated all over Europe and America, with a parchment document accompanying them (charged with a stamp that costs £3, 10s., exclusive of official fees,) certifying that they are true copies of the English *standard*."

Government, the Exchequer, and the custody of national standards.

After this, it is not surprising, that when the Astronomical Society of London had prepared a standard of length of their own, modelled on that previous Parliamentary standard destroyed at the great fire in 1834, they hesitated to trust it to the care of Government; and one of their number wrote in argument some years after, and under the auspices of Lord Brougham's Society for the Diffusion of Useful Knowledge, "That the Government knows and cares nothing about the standards, is obvious from the legislation which has taken place since the legal standard was destroyed; and it would not do to let the nation possess a scientific record of the first importance, to be broken by Exchequer officers, or altered in length by a blow given for the purpose of impressing a Government stamp."

Alleged errors in both the theory and practice of Government, touching national standards.

These are sadly severe remarks, and yet the Exchequer itself has indicated their truth by publishing the Astronomer-Royal's views, *first*, on the error in the general *theory* of British legislation on the subject of standards, as shown in "the entire apathy on the part of Government towards the matter, whereby it acts only when pressed by popular demands;" and *second*, the error in the *practice* of the British Executive, which is, within its functions, very similar to the above; leading also to such scenes as the following, extracted from Mr. Chisholm's report:—

"In answer to a question upon this subject in the House of Commons, Sir George Grey is reported to have said (see *Hansard*) that 'the Standards (Exchequer) had been examined; some adjustment was found necessary, and measures would be taken to have them verified.' It is probable that the answer of the Home Secretary was imperfectly heard or misapprehended, as no examination, comparison, or adjustment whatever of the Exchequer Standards has been made."

Recent improvements in Government practice.

Since the earlier critiques were published, however, we trust, and indeed we know, that the members of Her Majesty's Government have grown both in knowledge and conscientiousness, and there has been further reporting both by Parliament and Scientific Commissions on improvements in the national standards. Some little enthusiasm has even grown up in par-

ticular corners about British science and British principles of metrology.

Vicious theory, in Metrology.

Nothing, however, of very grand character has been either proposed or accomplished, and the minor modifications given rise to, have unhappily too often tended to continue that fatal scheme of the upper classes, for alienating the weights and measures of the country from their first, and true, purpose, of serving most efficiently and directly the pressing purposes of the working poor, into ministering towards the mere convenience of the idle rich.

Advent of a new party.

But quite recently, and while their nibbling, though designing, processes were in methodical operation, the performers have been startled by the explosion of a mine of their own order, under their very feet. The merchants and manufacturers of the country, always a noisy set, making far more cry than equivalent to their wool, as Sir Robert Walpole said of them a long while ago, in his description of trying to shear a pig, have burst into the arena, and declare that they cannot wait for the slow improvements of Government; neither care they one straw for British science, either practical or theoretical.[1]

These men of the new party are in fact hasting to be

[1] See *Athenæum*, p. 503, for 1864.

rich—very rich. Rich already, as they are, they seek to add still more riches unto riches, and in the speediest possible manner. What though "wealth" be the number of the Beast of Revelation,[1] wealth they must have, and accumulate unto themselves, without reference to their fellows or their future. With the creed that they worship, of the whole duty of man consisting in "buying in the cheapest, and selling in the dearest, market,"—they fancy that their operations receive a momentary check in some foreign countries, by the different metrological system there and here,—so immediately, without weighing the whole case, or considering whether, by breaking down the barriers between France and Frenchified countries and ourselves, they may not be raising up other obstacles between ourselves as so altered, and Russia,[2] America, and Australia,—they are calling out and demanding that French weights

Hasty and other characteristics of the new party.

[1] See Mr. John Taylor's work, *Wealth, the Number of the Beast.*

[2] Amongst many other symptoms of strong and youthful vitality, and promise of its future pre-eminence in the affairs of the world, Russia scorns to adopt the French units of measure. Some interested parties recently went to St. Petersburg, trying to persuade its citizens to adopt the French system; on the plea that Belgium, Holland, Sardinia, Tuscany, Spain, Portugal, Greece, Switzerland, and several countries of South America, had already joined it, and that Great Britain *was just going to do so.* But Russia was nothing moved by that, and though all the world was going to submit itself to France, she, Russia, was not; she knew the value of her own hereditary measures, connected at one point with the English system, and she would as soon give up her language, as her ancient metrology, adapted to, and loved by, her people.

Russia's place in Metrology.

Demand the introduction of French measures.

and French measures be instantly adopted by law from one end of Great Britain to the other, under pains and penalties of the most compulsory order.

Power of the new party.

At the very present moment, indeed, even while we write, the movement is portentous; there is a positive bellowing for those French units, entire, absolute, and immediate; so that both Government and the pillars of British science, which it has been latterly collecting about it, are rocked to their foundations in dismay; and hear cries on all sides about their ears, that if they do not hasten to give what is demanded, there shall be "free trade" in these things established; and both science and ruling men shall be imported from abroad, to carry out the wishes of the dominant merchant class.

Consternation of the Government and *savants* of Britain.

Historical speculations on the future of Europe.

Some wise and far-seeing writers, who have speculated philosophically on the future history of Europe, have already during many years seen, personified in France, the whirlpool which is to draw all other neighbouring countries[1] into itself; and amalgamate them as completely into one French lump, as are the ancient governments of Burgundy and Aquitaine at this moment. Some special circumstances of a spiritual and religious character, they think, and hope, may enable Great Britain to stand out longer than other

[1] Not Russia.

states; but they are not sure she will be able to maintain herself to the end; and if she does so fail, this maddening outcry against *British hereditary measures,* and about, not their improvement, but their entire abolition, and replacement by French weights and measures,—is precisely one of the most hearty aids which Satan, and traitors to their country, ever had presented to their hands. Downfall of British independence?

But what care the majority of the class, from which the cry issues, for patriotic motives? Why, one of the wealthy and political manufacturers of Birmingham declared some time since, half threateningly, in public, that the British farmers would rather live under the rule of the French Emperor, and were ready to waive their supposed advantages as British farmers, if the Government did not alter some bye-law, that was preventing British farmers just at that moment, from realizing quite such large profits from one of their articles of produce, as they could have done if in France. Money is the first thing, and the second thing, and the third thing, for which that politico-mercantile class cares; a class, too, acquiring more influence amongst us every year; so that there soon will come to pass as an accomplished fact, if it be not already come, that saying of a shrewd Norseman, in Peculiar patriotic ideas of the new metrological party. Their devotion to money.

imitation of Jugurtha's ambassador describing Rome, "*Omnia* ANGLIÆ *venalia esse.*"[1]

Oppression of the poor by the new, more grinding than by the old, party.

In the midst of such a headlong pursuit of wealth, the *poor* unfortunately are the first to go to the wall. They may have been somewhat curbed and bridled in past times by kings and barons and government servants,—but what is that, to the oppressions of merchants and mill-masters hasting to be rich? Even in this one item of French weights and measures, and in their final establishment by Act of Parliament, what seeds of poison to patriotism are sown,—and in the very class whose patriotism is most essential to the existence of a nation, viz., its working poor,—sown broad-cast and without compunction.

There is not, indeed, a completer way, than by such a forced introduction of foreign units, for telling every poor man in the country, and twenty times a day, whether he is in the field or in the house, that his convenience and comfort in necessaries, are sacrificed to the enjoyments of the rich, in their superfluities; that his country has abandoned him, and that its ancient institutions have ceased to have any peculiar value to any one whatever.

There is evidently no mercy nor escape for the

[1] E. O. Vinje, *A Norseman's View of Britain and the British.*

doomed working man; for public documents inform us that the Committee of 1862 arrived "unanimously at the conclusion, cautiously and steadily to introduce into this country the French metric system,' adopting its nomenclature also; at first merely *legalizing* its use, and then, after a time, rendering it compulsory."

Inquisitorial and compulsory intentions of the new party.

The Committee were indeed told, from the reports of the Astronomer-Royal and elsewhere, "that the said forcible introduction of foreign weights and measures into Great Britain would be to the *excessively great inconvenience* of 9,999 persons out of every 10,000 of the population, and the gain to the one person in 10,000 only small; and that any interference of Government for compelling the use of foreign measures in the ordinary retail business of the country would be *intolerable;* that they could not enforce their penal laws in one instance in a thousand, and in that one it would be *insupportably oppressive.*" Yet all the effect that this information produced on the politico-merchants of peace principles was "to look forward to a comprehensive and exact system of inspection, and the establishment of an efficient central department to give force and unity to local action."

Warning of the consequences, only confirms them to use force.

No wonder the *Times* wrote on July 9, 1863:—"A very great trial is impending over this free and happy

Ideas on their proposals, by the *Times* newspaper.

country. It is not the loss of our cotton trade, of our colonies, of our prestige, or our maritime supremacy. It is a change that would strike far deeper and wider than any of these; for there is not a household it would not fill with perplexity, confusion, and shame. From a division in the House of Commons yesterday, it appears that we are seriously threatened with a complete assimilation of all our weights and measures to the French system. Three years are given to unlearn all the tables upon which all our buying and selling, hiring and letting, are now done. Three years are supposed to be amply sufficient for undoing and obliterating the traditions of every trade, the accounts of every concern, the engagements of every contract, and the habits of every individual. But we very much doubt whether the general shopkeepers, who take possession of the corners of our small streets, or the green-grocers, will be able in three years to translate their accounts into Decas, Hectos, Kilos, Myrias, Steres, and Litres, Metres, Millimetres, Centimetres, and the hundred other terms extracted by our ingenious neighbours from Latin or Greek, as may happen to suit their purposes. Is the House of Commons, then, really prepared to see the votes, the reports, the returns of the revenue, the figures of the national debt, all run up in paper francs and actually paid in gold Napoleons?"

The *Times* condemns their unpractical and pro-French tendencies.

Yet this is, as the *Times* remarks, the necessary consequence of that vote, if it is to have any effect whatever; and if that be the consequence, the result cannot be very difficult to foresee, and a result which every lover of his country will strive to the utmost, in whatever his calling in life may be, to avoid and prevent.[1]

What British Metrology requires.

Some improvement, however, of British Government weights and measures ought to be made, in order to bring the country up to its intended *Magna Charta* resting-point; and at the same time, in such improvements, considerable extension of ancient handicraft systems should be introduced, to suit the progress of scientific professions in the present day; but all this must be done alike with breadth and simplicity, as well as in accordance with, or rather reproduction of, hereditary maxims and principles, and possibly something higher.

That is the great problem before the practical patriots of Great Britain at this present moment.

The so-called "British Imperial System" of weights and measures, from George the Fourth's time, has emi-

[1] This result seems to have been postponed for a time by the Parliamentary proceedings of May 4, 1864; when Mr. Ewart's bill, after two readings, was withdrawn in deference to a proposal of Mr. Milner Gibson. But as Mr. Cobden professed himself quite unable to see the difference between the two, though allowing there might be some,—and we know already what are the ultimate compulsory intentions of the promoters of the bill,—it is plain that the thin end of the wedge is already introduced to destroy our British hereditary metrology.

Failure of the system produced in the reign of George IV.

nently failed to accomplish what is required. The recent reports of the Legislature give no hope of their making any sensible improvements for ages; or even of their working in the right direction, viz., of considering the poor, and the working men, amongst whom we must class practical scientific men of every kind and degree,

Unpractical men objected to, in metrological legislation.

—but no metaphysicians, or logicians, or moral philosophers, or lawyers, or merchants, and very few Members of Parliament, or high officers under Government.

We except all these classes, primarily, and still can ask, "For the bulk of the people, what can be done; or what ought to be done?"

Leading principles to be observed.

What ought to be done, is, what will suit the practical workers first, and the others next; and if that which is then done, be afterwards haply found to chime in with the oldest and grandest and truest system ever yet invented on the earth; a system wherein principles of science and the nature of men are both most eminently consulted and combined,—surely the right principle and end and aim will then have been attained.

These principles not to be found in the French metrical system.

Now this principle, even putting aside all national considerations for the moment, is not to be, and cannot be, obtained by the French metrical system; for that is founded on a most exalted contempt for both time and space and the stature of man, even though he be created

in the likeness of God. Man and nature were indeed both trodden under foot by those Gallic philosophers of the Revolution. A pure artificiality was preferred by them; and all human affairs were cooked up by their chiefs into a decimal pie, and sacrificed at the shrine of *one* arithmetical facility.

The principle tested by events in the first French Revolution.

If our previously expressed view be just, that weights and measures are primarily the affairs of the poor of every nation,—then when the poor did get so completely the upper hand, as they did in France at the first French Revolution,—it was only to be expected, that some thorough overhauling of the metrology of that country should follow. And so it did. But then again, when the French people pronounces for anything whatever, who so ready to be led away by an "idea;" and to allow the peasants of their country to fall slaves before the crotchets of the learned of Paris?

Artificiality of all the French units, unsuits them to the poor.

So it was with the "Metrical System," one of the longest-lived of those "prodigious infants," to which that popular revolution gave birth. Its units, as they were finally determined in Paris, are too artificial and also too large for the common people. Any man of British-born can show from his own body at once an approximate inch, or foot, because those measures have approximately that natural foundation; but a French-

man must get a divided scale into his hands before he can show you a metre or decimetre; for they exist nowhere except on the scales of brass, or boxwood, or ivory, divided by the skilful amongst his compatriots.

French units generally too large for the poor.

Again, a unit for the poor should be *small*, because it is a much plainer proceeding to be dealing with whole numbers than with fractions. Only think of the scenes of ineffable bewilderment which would occur over all this country, were it to be Gallo-metricalized as proposed by Messrs. Ewart, Cobden, and their friends in the House of Commons. An ancient lady three years hence inquires the price of half a pint of milk, and is told by the shopkeeper that he "dare not sell her that measure, lest he be sent to prison by the apostle of commercial peace and good-will to all men; but he can legally sell her," and here he makes a calculation, "0·028 of a litre, which is not far from half-a-pint, and that its price is only 0·0666, etc., of a francobungus; or positively dirt cheap, if she can only see it." Will not the old lady be appalled; and how ever will she be able to perceive all the bearings of this state of affairs so instantly, as to make her small means go to the same distance in marketing for a large family, as they had been wont to do before?

Fractions objected to in practice.

But it is not only these antique dames who have more

trouble in dealing with fractions, than with whole numbers. It is a law that affects all the human race, more or less; and it is a most noteworthy circumstance, that when Sir William Armstrong was officially demanding the other day at the Newcastle meeting of the British Association, for the adoption in this country of the French metrical system,—he mentioned, as if in favour of it, a practical fact, which really exposes the very root and essence of the unsuitableness of that system, both to human life and real circumstances; and tells what the working men of our land have already actually done, as a *pronunciamento* against it.

Sir William Armstrong involuntarily supplies a case in point.

"In the Elswick works," (his own,) said he, "as well as in some other large establishments of the same description, *the inch is adopted as the unit*, and all fractional parts are expressed in decimals."

Engineering workmen at Newcastle take the *inch* as a unit.

Mark, the *inch*, not the yard, which the Government Commission of wealthy men have recently been recommending as the new British unit;[1] or, something like the metre, still bigger than the yard; and which might suit those wealthy men's pleasures, but

They object to so large a unit as the yard, or the metre.

[1] The last Commission have pronounced on this point so decidedly, as to propose, that new names shall be invented for collective portions of 1000, or 2000 such unit-yards, with a view to their ultimate employment in place of the British mile; which they recommend shall gradually be dropped out of use and rendered obsolete. We pray confusion to their insidious designs on a patriotic and unsuspecting people.

not the work of the industrious population on the banks of the Tyne; those deserving men to whom we owe our coal, and our glass, our steam-engines, railways, and now even our guns for the defence of the country. All these men have chosen anew for themselves the inch, as the real British unit. Like their Anglo-Saxon forefathers, they have found out its value for themselves; and fully approve it in their daily work. From a different part of the country, too, and an opposition manufactory, similar evidence has been given; for Mr. Whitworth, in his examination before the Lords' Committee in 1855, exhibited an *inch* measure, with an apparatus for testing its length to the millionth of an inch; and insisted on "the greater importance to all who are engaged in the mechanical arts, to have a standard foot, and a standard inch, than to have a standard yard."

Small linear standards preferred also in Birmingham.

All fractional parts of such a unit inch, "are expressed," says Sir William Armstrong, "in decimals." Very good; but that does not make it the French system. The French did not invent decimals; decimals of 10 as the radix, arose from men having ten fingers on their two hands; and therefore decimals belong to the oldest systems of all. They are too, in so far, a mistake in the French arrangement; and the French philosophers them-

Decimal subdivisions common to other systems than the French alone.

selves have often regretted since they started their novelties, that they did not make 12, both the radix of numerical computation, and the principle of metrological subdivision. Some persons have even proposed 16, as a more powerful radix in itself, and further removed from the hated reminder to them, that man was born with his two hands subdivided, each of them, into five parts.

Artificial schemes of numeration.

This version of the case, is however in fact, even a more important feature, than that the sum of the fingers of both hands, makes 10; and it is what the *Great Pyramid* eminently teaches; as well as being that also, which the recent proceedings of many nations, high in the world, indicate should be insisted on again and again, until fully turned to practical account. Ten is a very good number; but it certainly is not in some things so suitable as five, and in others as powers of five. Accordingly, the Pyramid embodies in a variety of ways the importance of 5; for it is a structure,—as partly alluded to before,—with five sides, and five angles, abstractly; and architecturally, a building with five corner-stones; besides reproducing the number again and again in its several linear standards.

The Pyramid system of numeration.

Further still, that wonder within a wonder of the Great Pyramid, viz., the porphyry coffer, speaks of five;

The Coffer, as a symbol of five.

for it is a vessel of five sides; we may even say that it could not have been otherwise; and that that is at once an explanation why all the searching of all the nations of the world during the last five hundred years, has never been able to find that coffer's fancied lid. A lid would have been a sixth side![1]

[1] The earliest testimony, as well as the latest, has always spoken to the absence of a lid, or to the coffer being a lidless box. More modern accounts have been further precise in describing the smooth and geometrical finish of the upper part of the coffer's sides, without any of those grooves, dovetails, or steady-pin holes, which have been found elsewhere, in true polished sarcophagi, where the firm fastening of the lid is one of the most essential features of the whole business; indeed an example was found no further off than in the third pyramid of Jizeh, and (see Colonel Howard-Vyse, vol. ii. p. 84) on the granite sarcophagus discovered there. The exquisite line-engravings of the Great Pyramid coffer, in the *Description de l'Égypte*, also represent it smooth and perfect within itself, and without any fixing marks along the upper edges, or any indications of a lid having been at any time intended; and Professor Greaves would never have thought of measuring the internal edges with such extraordinary care as he used, if they had been disfigured with grooves, dovetails, or lid-fixing machinery.

Coffer always lidless.

Mr. Jopling's idea, that the Coffer was *intended* to be lidless.

In *The Leisure Hour* for May 1863, a further reason is given, on p. 334, by Mr. Joseph Jopling, architect, why the porphyry coffer should have been considered complete without a cover, viz., that *the cubic contents of the interior are exactly half of those of the exterior!* On testing this idea by the three best sets of measures in our table, p. 103; or, those of Greaves, Jomard, and Howard-Vyse,—the result has the merit for Mr. Jopling, of coming out in the mean, much closer to his expectation, than in any single observer's measures, taken by themselves; the numbers running thus, entirely uncorrected for errors of observation; which are, however, so lamentably great, as to call loudly for re-measurement:—

	$\frac{\text{Exterior.}}{2}$	Interior.
Greaves, . .	= 69,128	71,118
Jomard, . .	= 79,992	77,469
Howard-Vyse, .	= 72,355	71,311
Mean, . .	= 73,825	73,299

With five, then, as a number, times of five, and powers of five, the Great Pyramid contains a mighty system of consistently subdividing large quantities to suit human requirements; and it is now our business to see how these principles are applicable, to the actual values which we previously ascertained its great standards to possess, in generating a complete metrological system; which shall be primarily adapted to the poor and to scientific men; secondarily, to the rich and governing classes; and thirdly, shall produce the least possible change in names and absolute quantities, to early British, Magna Charta, and recent Imperial, systems.

Construction of a practical Metrology on Pyramid data.

Principles to be observed.

CHAPTER II.

CAPACITY MEASURE.

THE grand standard of capacity of the Pyramid, as already stated, is given by the contents of the porphyry coffer, which we shall term shortly "the coffer," = 4 quarters English; or more exactly = 70,970·2 English cubic inches; but of Pyramid inches = 70,900.

Subdivision of the Pyramid Coffer, for capacity measure.

This whole quantity subdivides itself easily, in Pyramid fashion,—

Into 10 parts, each	= 1 sack English approximately.	
25	... = 1 bushel	...
250	... = 1 gallon	...
2,500	... = 1 pint	...
25,000	... = 1 ounce	...
250,000	... = 1 dram	...
25,000,000	... = 1 drop English apothecaries' and natural.	

We begin therefore with the large measured and scientific quantity of the coffer, and end with a unit which, in an approximate form, as a *drop* of water, is in every one's hands, and which is definable accurately upon the coffer by the stated proportion. The inter-

mediate capacity measures should be definable, both by reference to linear measure and to weight, the weight being some even multiple or part of the commonest unit of weight, and we have the following table of—

PYRAMID CAPACITY MEASURE.

Denomination.			Reference in Pyramid cubic inches.	Reference in Pyramid lbs. of water-weight.
	Unit	= 1 drop =	0·002836 =	0·0001
100	drops	= 1 dram =	0·2836 =	0·01
10	drams	= 1 oz. =	2·836 =	0·1
10	oz.	= 1 pint =	28·36 =	1·
10	pints	= 1 gallon =	283·63 =	10·
10	gallons	= 1 bushel =	2,836· =	100·
2·5	bushels	= 1 sack =	7,090· =	250·
10	sacks	= 1 coffer =	70,900· =	2,500·

And the following arrangement for double entry :—

PYRAMID CAPACITY MEASURE.

Drops.		Dram.		Oz.		Pint.		Gallon.		Bushel.		Sack.		Coffer.
100	=	1												
1,000	=	10	=	1										
10,000	=	100	=	10	=	1								
100,000	=	1,000	=	100	=	10	=	1						
1,000,000	=	10,000	=	1,000	=	100	=	10	=	1				
2,500,000	=	25,000	=	2,500	=	250	=	25	=	2·5	=	1		
25,000,000	=	250,000	=	25,000	=	2,500	=	250	=	25	=	10	=	1

The British and the Pyramid capacity measures compared.

In contrasting this arrangement with the British Imperial system, we may see at once that that system is merely a measure for large and rude quantities, knowing of nothing smaller than the pint (the gill being merely a later tolerated addition to suit special wants); and

rendering it therefore necessary for the apothecaries and druggists to manufacture a sort of fluid measure for themselves, starting from the pint, and ending in the drop; or, as they term it, with needless adoption of Dog Latin, a "minim."

British capacity measure broken between Imperial and Apothecaries'.

This Apothecaries' fluid measure was established only in 1836; and we assume with the *Penny Cyclopædia*, that such fluid ounce, when it is an ounce, is an ounce avoirdupois; although it is stated elsewhere, that medical men are never to use anything but Troy weight. This uncertainty renders the break between Imperial capacity, and apothecaries' capacity, measures peculiarly trying; followed as it is by a break of connexion between apothecaries' capacity, and apothecaries' weight, measures also.

Thorough nature of Pyramid capacity measure.

In the Pyramid arrangement, however, there is no halting half-way; but, when it is a question of capacity, the scheme goes right through from the biggest bulks ever dealt with in commerce, and through all the measures required further in dealing with coal, corn, wool, potatoes, beer, wine, peas, meal, oil, medicines, photographicals, and chemicals, up to the smallest quantity ever dealt with by capacity measure of any kind or degree.

Then, for the testing of these bulks by weight, the

Imperial system has only one strikingly even equivalent, viz. the gallon, = 10 lbs. of water weight; but that is accompanied by the double drawback, 1st, that 10 lbs. in weight is not an Imperial known weight; and, 2d, that the gallon is not the unit of the Imperial system. Tests of Pyramid capacity measure.

The unit of the Imperial system is a pint; and it is moreover the point of connexion between the Imperial system for large ordinary quantities, and the Apothecaries' system for scientific and medical small quantities. It is therefore the point of all others in the scale which should be round and complete, and testable also at a moment's notice, by an equally round, well-known, and frequently employed standard of weight.

So it was too, in the days of the wisdom of our forefathers, or the times of instinctive strength of hereditary tradition; but under George the Fourth, that disastrous tendency to take measures from the poor, and lay them at the feet of the rich, had already begun; and so the pint, from having been the unit, as 1 pound's weight of water, was turned into the odd quantity of 1 and ¼ pounds; and the bigger measure of a gallon, with which the poor man has seldom to deal, was made equal to the round sum of 10 pounds. The old British capacity unit interfered with by the Imperial system.

This flagrant tampering with the hereditary rights of the poor, was attempted to be coated over with proverbial mail, by the formal giving out of this saying, to be learned by all men in these latter days,—

"A pint of pure water,
Is a pound and a quarter;"

Coincidence of old proverbial rhyme with Pyramid teachings.

But, treason or no, we doubt whether every peasant has yet got that distich by heart, and whether he does not rather ruminate over the far older and pithier rhyme—

"A pint's a pound,
All the world round;"

An expression in which there may be vastly more than immediately meets the eye, seeing, as in our above table, that the Pyramid system restores the truth of that ancient proverb to this country; and may have imparted it in ages long gone by, to many other countries also, to prove them if they could be faithful to their covenant.

Almost every one of the Pyramid capacity measures, however, admits of being tested by a round number of "water-pounds;" and that number is always such a one as we shall see presently, does really exist in the Pyramid system of weight and measure.

We have, therefore, only to conclude this division of the subject, by submitting a table of comparison of each Pyramid capacity measure with each similarly named

current capacity measure in Great Britain, through means of the common medium of English cubic inches; whence it will be seen that, excepting the "coffer," which is hardly altogether unknown to our nation ("chaldron" having been under Anglo-Saxon rule an expression for, and a description of,[1] it), there is no need to invent any new names; for, under the existing names, as of pints, gallons, etc. etc., the absolute capacities have often varied much more than here indicated,[2] and without a tithe of the reason for it.

Accurate Imperial values of Pyramid capacity measures.

PYRAMID AND BRITISH CAPACITY MEASURES, COMPARED THROUGH THE TEMPORARY MEDIUM OF ENGLISH CUBIC INCHES.

		English cubic inches.			English cubic inches.
1 drop Pyramid,	=	0·0028388	1 drop fluid Apoth.	=	0·0036103
1 dram,	=	0·2838808	1 dram,	=	0·2166187
1 oz.,	=	2·838808	1 oz.,	=	1·73295
1 pint,	=	28·38808	1 pint Imperial,	=	34·659
1 gallon,	=	283·8808	1 gallon,	=	277·274
1 bushel,	=	2,838·808	1 bushel,	=	2,218·192
1 sack,	=	7,097·02	1 sack,	=	6,654·576
1 coffer,	=	70,970·2	4 quarters,	=	70,982·144

[1] See Mr. Taylor's *Great Pyramid*, p. 144.

[2] In or about the year 1800, it was reported that in Westmoreland the following diverse measures were used; 1st, a *Winchester* bushel; 2d, a *customary* bushel, equal to three Winchester bushels; 3d, a *potato* bushel, equal to two Winchester bushels; and, 4th, a *barley* bushel, equal to two and a half Winchester bushels.

CHAPTER III.

WEIGHT MEASURE.

In weight the coffer becomes the *Pyramid ton.*

THE weight of the cubical contents of the coffer in pure water, at the Pyramid constant of temperature, = 68° Fahr. (or 50° of its own scale, when freezing = 0°, and boiling, 250°) has been already shown to be, 17,905,500 English grains; or those grains which have been established under the Imperial system in this country, both for Troy and Avoirdupois weight.

Now this total quantity we propose to call a Pyramid *ton*, because it comes between the ordinary British ton of 20 cwt., and the shipping ton, = 42 cubic feet of sea-water, = 24 cwt.

Next, subdividing this whole weight, strictly in terms of the Pyramid,—we find, that it easily separates

Into 10	parts, each	= 1 English wey approximately.
25	.	= 1 English cwt.
250	.	= 1 English stone.
2,500	.	= 1 English pound.
25,000	.	= 1 English ounce.
250,000	.	= 1 English dram.
25,000,000	.	= 1 English grain.

We begin therefore, as before in the case of the capacity, with a large quantity most scientifically referred to the size and weight of the earth; and practically well determined in a magnificent and lasting standard; and terminate at last with a "grain." But what sort of grain?

Pyramid derivation of *Troy* weight.

Not an Imperial grain sensibly, in the proportion of 179 to 250. But the Imperial grain itself, is a violence and an innovation on the original rule of the country. The old law was, that 32 grains should make a pennyweight, 20 pennyweights the ounce, and 12 ounces the pound Troy; which name, Troy, Mr. Taylor (p. 189 of *The Great Pyramid*) deduces with much probability from the old Saxon word for "trough," as "trough-weight," or weight derived originally from some kind of trough; viz., he says, that world-distinguished stone trough, as it has so often been called by travellers involuntarily, of the *Great Pyramid;* or, the porphyry coffer of the King's Chamber.

Of Grains anciently in British weight.

In that olden day, then, of genuine British principle, 7680 grains made a pound Troy; and a grain was the unit of weight. One of these grains, too, was a unit identifiable in a moment, for common purposes of life, because it was actually a fair, ordinary, grain of wheat.

Troy weight, then, was evidently, in its origin, well adapted to the poor and humble, without being really

any less suitable to the rich. But the rich could not let the poor alone, even in so simple a matter; and must begin to introduce devices to increase the size of the weight unit; and take the power of examining into its truths, out of the peasant's sphere.

Legislative interference with the old English weight-grains.

Accordingly, after a time, a very needless act of Government declared, that the 32 grains, collected as heretofore out of the middle part of an ear of wheat, should in future *be divided into* 24 *grains;* so that the pound Troy should then only number 5760 legal grains. A miserable shift; but going with such untiring pertinacity to one general, secret, constant end; and which end is not done with by our rulers even yet.

British grain-weights purposely enlarged and made artificial.

Immediately after that promulgation, Cocker, Wingate, and other old arithmeticians, used to enter, in their useful compendiums, that 32 *real* grains, or 24 *artificial* grains, made the pennyweight; and when that ingenious story was pretty well indoctrinated into the nation, then the 32 real grains were quietly dropped out altogether, and the 24 artificial grains stood by themselves; as weights which no poor man was able to account for, or refer to any approximate test.

The poor, though, notwithstanding the rebuff, continued to look for their lost grains; and their demands for the fuller number, may have been met by the intro-

duction of the "avoirdupois" or "*over du pois*" pound,— which contained more nearly the full number of grains to which they had been accustomed in a pound: but they were not their old grains. Nay, worse still, a proportion for the pound was adopted, that made grains quite an impossible luxury in that weight; for in avoirdupois, the peasant could not do otherwise than stop at "drams," whether spelt "drachms" or "dragmes," or in any other way, when below that item was the new-fangled fraction, 26·71875 grains make 1 dram avoirdupois. O peasant! peasant! for he was therein adjured by his Government to give up grains of any, and every, kind or degree, and make the far bigger *dram*, his unit; and what natural test for a dram avoirdupois could he turn to at a moment's notice, either in the air, or the earth, or the water under the earth! In fact there was nothing for him, from that moment forward, but passive obedience, and unquestioning acceptance of whatever his rulers chose to order him to receive.

British pound-weight re-modelled.

Agricultural weights deprived of any sort of integral grain-units.

So then arose the horrible confusion perpetuated ever since, of perversely different kinds of weights, jostling each other in Britain; Troy weight and Avoirdupois weight and Apothecaries' weight, wherein or whereamongst every one is at sea with regard to testing them, and no one whatever is satisfied.

Confusion of weights all over the land.

The Pyramid system practically restores the ancient British grain unit.

In the midst of this medley, however, the first information from the Pyramid coffer is, that its Pyramidal division into 25,000,000, restores almost precisely, the poor man's grain, *i.e.*, "the natural grain," *i.e.*, "the real grain," and that is, the grain of *Magna Charta* time; at least it does so in the proportion of 239 to 250.

There need not therefore now be any apology for the coffer grains being smaller than those of King George the Fourth's Imperial system; and they will be found in the general scheme of weight measures to suit all the modern purposes of science, with notable arithmetical advantage.

PYRAMID WEIGHT MEASURE.

Denomination.			Reference to Pyramid cubic inches of water.	Reference in terms of Pyramid pounds.
Unit	= 1 grain	=	0·002836	= 0·0001
100 grains	= 1 dram	=	0·2836	= 0·01
10 drams	= 1 oz.	=	2·836	= 0·1
10 oz.	= 1 pound	=	28·36	= 1·0
10 pounds	= 1 stone	=	283·6	= 10·
10 stones	= 1 cwt.	=	2,836·0	= 100·
2·5 cwt.	= 1 wey	=	7,090·	= 250·
10 weys	= 1 ton	=	70,900·	= 2,500·

and when arranged for double entry,—

Grains.	Dram.	Ounce.	Pound.	Stone.	Cwt.	Wey.	Ton.
100 =	1						
1,000 =	10 =	1					
10,000 =	100 =	10 =	1				
100,000 =	1,000 =	100 =	10 =	1			
1,000,000 =	10,000 =	1,000 =	100 =	10 =	1		
2,500,000 =	25,000 =	2,500 =	250 =	25 =	2·5 =	1	
25,000,000 =	250,000 =	25,000 =	2,500 =	250 =	25· =	10 =	1

Contrasting the Pyramid weight measures with the existing British, the former are found to go through the whole scale of weighing, from tons to grains, without any break; and with a reference test, at every step, to a known and easy Pyramid capacity-measure of water; but the latter, or the British, begin at tons with Avoirdupois measure, and very small tons; go through hundredweights so called, which do not consist of a hundred pounds; and finally, after dealing with arithmetically awkward divisors, end at drams,—just the point where science begins to be particular. Easy water-test of Pyramid weights.

Therefore it is, that Druggists are obliged to buy wholesale by Avoirdupois, and then dispense retail by Troy or Apothecary weight; for these last are the only British weights, that enable them to deal with grains; and yet those are not real grains.

The Pyramid weights, therefore, offer an escape to the British nation out of the confusion of ages, and the false leadings of unpatriotic legislation in high places; as well as from pounds which mean nothing that is marked in nature, or appreciated in science. No new names are required, and the proportions of matter under each denomination as used in the Pyramid, and in British nomenclature, are as follows :— *Thorough* nature of Pyramid weight system.

PYRAMID, AND BRITISH, WEIGHT MEASURES COMPARED THROUGH THE TEMPORARY MEDIUM OF ENGLISH GRAINS.

1 grain Pyramid, =	0·71622	1 grain old English,	=	0·75000
		1 grain new English,	=	1·00000
1 dram Pyramid, =	71·622	1 dram Avoird.,	=	26·71875
		1 dram Apoth.,	=	60·00000
1 ounce Pyramid, =	716·22	1 oz. Avoird.,	=	427·5
		1 oz. Troy and Apoth.,	=	480·0
1 pound Pyramid, =	7,162·2	1 pound Avoird.,	=	7,000·
		1 pound, an ancient weight preserved at the Exchequer, but of unknown origin,	=	7,136·
		1 pound old English and Scotch,	=	7,600·
1 stone Pyramid, =	71,622·	1 stone meat,	=	56,000·
		1 stone wool,	=	98,000·
1 cwt. Pyramid, =	716,220·	1 cwt. Avoird.,	=	784,000·
1 wey Pyramid, =	1,790,550·	1 wey English,	=	1,274,000·
1 ton Pyramid, =	17,905,500·	1 ton Avoird.,	=	15,680,000·
		1 ton shipping,	=	18,816,000·

CHAPTER IV.

LINEAR, SURFACE, AND CUBIC, MEASURE.

Linear, the first of all measures.

WE have now arrived at the commercial arrangement of the most important of all the measures of a nation; at that one which requires to be attended to first, and which *was* first attended to, and secured with more than sufficient accuracy in the Great Pyramid; viz., Linear measure.

Its Pyramid unit, the *Inch*.

The unit of this measure is the inch; and the inch is roughly a thumb-breadth, to any man who has ever lived on the earth for the last four thousand years. During four thousand years, what empires, and races of men, and languages too, have passed away from the face of the world! therefore what thought of man, or rather what artificial edict, though it may have been promulgated from the city of Paris itself, or by a leading man of "London society," is secure of living sensibly unchanged for a similar enormous space of

time? Yet during that entire period, the mean stature of man is declared, by the tombs of Egypt, to have remained sensibly unaltered.

The poor man's approximate test.

A thumb-breadth, then, is no indifferent test-reference to every poor man, for realizing when in haste the unit of his measure of length; and the working men of Newcastle, according to the unintended testimony of Sir William Armstrong before the British Association of 1863, have practically by their deeds and in their works, pronounced indubitably for the inch, wherever accuracy is concerned.

It was so in olden times as well; viz., that the English unit was the inch, and not those larger measures, of yards or mètres, which the wealthy have been hankering after of late.

Exchequer *Standards*, not the *units*, of British measure.

The old Exchequer *standards*, spoken of in 1742, marked E, and supposed to date from 1580, were, as reported at the time, one a yard, and one an ell; but that did not make either the one or the other the *unit* of the country. Where the unit is small, the public standard must inevitably consist of a number of the units strung together; and the incommensurability, except through their component inches, of that pair of measures laid side by side, the yard and the ell, might have reminded men in subsequent times of the true

state of the case. But no; the rich men were in power, and the poor men, for consistency's sake, were pushed to the wall,—so the unit of the country during the last century has been endeavoured to be proclaimed, the huge and unscientific quantity of a yard.

Various attempts to alter the hereditary British unit.

That the efforts of the British upper classes have long been really directed to this end; and that in making so much, as they have during late years been doing, of the yard, they have intended it as a new unit, and not as a convenient number of the ancient small units arranged together to suit a special purpose of commerce, we subjoin the following words of the Act (June 1824):—

Commanded at last by the House of Commons.

"The straight line or distance between the centres of the two points in the gold studs in the straight brass rod, now in the custody of the Clerk of the House of Commons, whereon the words and figures *standard yard of* 1760 are engraved, shall be, and the same is hereby declared to be the original and genuine standard of that measure or lineal extension called a yard; and that the same straight line or distance between the centres of the said two points in the said gold studs in the said brass rod, the brass being at the temperature of 62° Fahrenheit's thermometer, shall be, and is hereby denominated, the *imperial standard yard*, and shall be, and

is hereby declared to be, the *unit*, or only standard measure of extension."

Parliamentary idea of an original measure.

The powers of an Act of Parliament are believed to be immense, but perhaps not altogether equal to their ambition; for while the above new standard yard had engraved on it "1760," and was known to be a copy of Bird's standard of 1758, and that of the Royal Society's scale of 1742, and that of the Tower yard, and that, at an earlier period, of the Exchequer standard of Queen Elizabeth, which dates about 1580, and which was there, in its place at the Exchequer, in 1824, and still is in possession of Government,—yet the Act declares its own yard of 1760 to be "*the original and* genuine standard," of that "measure called a yard."

Uneasy effect on the nation.

Yet a yard-unit comes, even on the rich people of the country, rather awkwardly; or they are striving at something still greater, for the Astronomical Society's new scale of 1835, as well as those of Troughton, Sir George Shuckburgh, and others, were oftener of five feet than three. At three, however, it has been eventually settled by the last Parliamentary commission,[1] and at three

[1] The Commission of 1838 had been thorough enough to consider all the following points:—

A, Basis (arbitrary or natural) of the system of standards.
B, Construction of primary standards.
C, Means of restoring the standards.
D, Expediency of preserving one measure, etc., unaltered.

feet it will legally remain until some great constitutional exertion be made to rectify it.

The peculiar scientific virtue of the Inch, re-discovered by Mr. Taylor from the Pyramid.

During all the time, too, that it has remained there, a most artificial and naturally incommensurable quantity with anything,—there never seemed to be the slightest suspicion, until Mr. Taylor announced it from his pyramid studies, that each of the 36 inches of which the modern British Government standard is composed, contains within itself all that natural applicability and scientific perfection which is desired, but in vain, to do honour to the longer measuring-rod of the rich. For each single inch is, almost exactly, the $\frac{1}{500,000,000}$th of the earth's axis of rotation.

Close approach of Pyramid Inch and British Inch.

Almost, only; for it requires 1·00099 of an English inch to make one such true inch. An extraordinarily close approach; and yet if any should doubt whether its closeness can be real, we can only advise them to look to the original documents, and see how easily it might have been much closer. Nay, it *would* have been very much closer had not the authorities been so bent on ousting the inch and adopting the yard; for it

E, Change of scale of weights and measures.
F, Alteration of the land-chain and the mile.
G, Abolition of Troy weight.
H, Introduction of decimal scale.
I, Assimilation to the scale of other countries, etc.

British Inch might have been still closer, to Pyramid.

was in this point of view that they allowed the ell-measure, of equal date and authority with the yard, and of a greater number of inches (45 to 36), and therefore a more powerful standard, to drop out of sight. In dropping it out of sight, they lost almost the very Pyramid measure itself, and robbed their country of the hereditary glory of keeping faithfully to inches of the true earth proportion and of more than human accuracy, a gift unknowingly received from more than primeval times.

The ancient inches of the country then, we may fearlessly say, were closer to the truth of the earth and the Pyramid, than the modern legal inch.

Different lengths of inches on the different British Standards.

That legal inch was derived from the Exchequer yard-standard through means of Bird's copy in 1760 and other copies, and was therefore intended to be one of the inches of that yard; but the inches of the ell were rather larger inches, and there were more of them, so that if either standard was taken as the sole authority, it should have been the ell.

The Ell's, longer than the Yard's, Inch.

Now when these standards were very accurately compared by Graham in 1743, before a large deputation of the Royal Society and the Government,[1] it was found that the Exchequer ell's 45 inches exceeded the

[1] *Astronomical Society's Memoirs*, vol. ix.

quantity of 45 *such* inches, as the Exchequer yard contained 36 of, by the space of 0·0494 of an inch. A result, too, which was in the main confirmed by the simultaneous measures of another standard ell at Guildhall, with an excess of 0·0444 of an inch, and the Guildhall yard with the excess of 0·0434 of an inch.

The Ell, the more trustworthy representative of ancient British measure.

Keeping, however, only to the Exchequer standard ell; and finding that it was not, after all, the Exchequer yard which was subsequently made (in Bird's copy) the legal standard of the country, but the previous copy of it, through a certain "Tower yard," and found in 1743 to be in excess by 0·0075[1] of an inch, on the Royal Society's scale,—we must subtract this quantity from the observed excess of the Exchequer ell; and then we get that its 45 inches were equal, in terms of the present standard inches of the country, to 45·0419.

But 45 Pyramid inches, are equal to 45·0446 modern English inches; whence it will be seen, that a Pyramid inch and an early English inch had a closeness to each other that almost surpasses belief. Whether the ancient lengths of the English inch be now restored or

The Ell inch agrees practically with the Pyramid inch.

[1] This is the quantity, or about it, by which the Royal Society's scale and those descended from it exceed the Exchequer yard, by what Mr. Baily calls "a very large quantity;" but he went to eight places of decimals of an inch in his measure, and he does not seem, unfortunately, to have looked at the Exchequer ell at all.

not, it will be abundantly manifest to every well-wisher of his country, that the *inch* must still be preserved, or rather legally restored, as the national linear unit; and upon that unit, the Pyramid multipliers will now be employed to prepare a table of linear measures.

A permitted extraneous Standard, in the Pyramid system.

We must, however, admit therein a small popular standard, viz. 12 inches, or a foot; it is not a scientific standard, and has no integral fractional reference to the earth; but so long as men and women are born with feet, we must respect it; and the Pyramid (as shown in Mr. Taylor's second size analogy, p. 42) respects it also.

Attending therefore to this circumstance, we have the following table of linear measure :—

PYRAMID LINEAR MEASURE.

Denomination.		Reference to Earth's Axis of Rotation.
Unit	= 1 inch	= $\frac{1}{500,000,000}$
and 12 inches .	= 1 foot	= $\frac{1}{41,666,666}$ etc.
but 25 inches .	= 1 arm	= $\frac{1}{20,000,000}$
10 arms .	= 1 rod	= $\frac{1}{2,000,000}$
10 rods . .	= 1 acre-side	= $\frac{1}{200,000}$
25 acre-sides	= 1 mile	= $\frac{1}{8000}$
and 4 miles . .	= 1 league	= $\frac{1}{2000}$ axis, and $\frac{1}{1000}$ radius.

Or arranged for double entry,—

Inches.	Foot.	Arm.	Rod.	Acre-side.	Mile.	League.
12 =	1					
25 = ...	=	1.	= Rod.			
250 = ...	=	10	= 1	Acre-side.		
2,500 = ...	=	100	= 10	= 1	Mile.	
62,500 = ...	=	2,500	= 250	= 25	= 1	League.
250,000 = ...	=	10,000	= 1000	= 100	= 4	= 1.

One new name has been ventured on here, the "arm," to describe the small Pyramid standard; but not a new word, and one that approximately expresses the length itself in language that any working man can understand and apply. The proportions of these measures, to those of the same denomination under the Imperial system, are as follows :— A new name ventured on.

PYRAMID, AND ENGLISH, LINEAR MEASURE, COMPARED THROUGH THE TEMPORARY MEDIUM OF ENGLISH LINEAR INCHES.

1 inch Pyramid	= 1·00099	1 inch English	= 1·000
12 inches	= 12·01188	12 inches	= 12·000
1 arm	= 25·02475		
1 rod	= 250·2475	1 rod English	= 198·000
1 acre-side	= 2,502·475	1 acre-side	= 2,504·525
1 mile	= 62,561·875	1 mile	= 63,360·000
1 league	= 250,247·500	1 league	= 218,721·600

The first remark to be expressed on this table, is the extraordinary approach of the acre-side of the Pyramid, to that of the British scale. It is a length which does not nominally figure on the usual English lists, though it exists through the square measure; and is, without doubt, the most important large measure by far which we possess; because it is the invariable term in which all the landed property of the country is bought and sold. Of the Acre, as a British land measure.

Reduction of its side to linear measure.

As such an all-important quantity to this country, one cannot at all understand how it was ever established by Government at such a very awkward proportion in the length of its side, to any of our linear measures; the fraction which it gives is rough to a degree, and yet, it will be observed, that the Pyramid principle hardly altering the real value to any sensible extent, makes it, in its own inches, at once the easy quantity of 2500, or in arm-lengths, 100.

The Acre, and the Mile, on the Pyramid system.

Nor does the advantage of the Pyramid principle end here, for the mile contains 2500 arm-lengths; and such a proportion has recently become a favourite with Government; that is, they have commenced a magnificent survey of Great Britain on the scale of $\frac{1}{2500}$th of nature.

The new Ordnance Survey, on the 25-inch scale, so-called.

This is by far a larger scale than either our own or any other country has ever been completely surveyed on yet, and infers such an infinity of drawing, copying, and engraving, that it could positively never have been thought of even in wealthy Great Britain, but for the previous invention of photography to do all the copying, and the electrotype to multiply the soft-engraved copperplates. Hence this survey of $\frac{1}{2500}$th is a remarkable public work of the present time, and intended to suit some purposes of the present and future hour.

That the scale is very large, implies certain advantages

which every one can understand in the use of a map. But why that particular proportion should have been adopted, is part of a secret piece of state-craft not yet divulged. Plainly $\frac{1}{2500}$ does not form any portion of the British imperial linear system; and when we are officially told that it was adopted to allow of the map being on the scale of 25 inches to a mile, or capable of representing an acre by one square inch, we are quite assured that that is *not* the reason, for the map is not on that scale. It *is* truly of the proportion of $\frac{1}{2500}$th of nature; and that gives, on the British measure, 25·344 inches to one mile, and 1·018 inches to an acre.

Why was that unsuitable scale, to existing British measures and maps, employed?

Immense inconvenience, therefore, results to the component members of the British nation, that the grandest and most costly survey of their country that they have ever paid for, and which is now in progress whether they like it or no,—does not fit in to their existing measures, but carries these annoying fractions along with it.

Inconvenience of it.

A suspicion has spread, that all this trouble has arisen out of some deep design to begin an assimilation of the maps of this country to those of a highly cultivated state on the Continent. But if so, there would seem a prospect of the mark having been overshot; for all that has been done, serves no system of measure so very completely, as the ancient acres and ancient miles of the

Secret design against British national measures.

Defeated by the Pyramid system.

Great Pyramid. The map itself remains, and may remain as it is, but a single Act of Parliament adopting the Pyramid measures for the country,—or, we might almost say, restoring the nation's hereditary measures to their proper place,—would cause the map to be at once a map on the scale of 25 inches to the mile, and of one square inch to the acre, without the smallest fraction left over or under; and would substitute truth, for falsehood, on every occasion when a Briton has hastily to mention the great national map of his country.

Truth and convenience of the Ordnance Map, in Pyramid land measure.

Touching the usual corollaries to linear measure, viz., those of surface and cubic contents, it may be enough now merely to exhibit their Pyramid arrangement in the following tabular expression:—

PYRAMID SURFACE MEASURE.

144 square Pyramid inches = 1 square Pyramid foot.
625 square Pyramid inches = 1 square Pyramid arm.
100 square Pyramid arms = 1 square Pyramid rod.
100 square Pyramid rods = 1 Pyramid acre.
625 Pyramid acres = 1 square Pyramid mile.
16 square Pyramid miles = 1 square Pyramid league.

Or—

Sq. inches.	Sq. foot.	Sq. arm.	Sq. rod.	Acre.	Sq. mile.	Sq. league.
144 =	1					
625 = ... =		1	Sq. rod.			
62,500 = ... =		100 =	1	Acre.		
6,250,000 = ... =		10,000 =	100 =	1	Sq. mile.	
... = ... =		6,250,000 =	62,500 =	625 =	1	Sq. league.
... = ... =		100,000,000 =	1,000,000 =	10,000 =	16	= 1

And—

PYRAMID CUBIC MEASURES.

1,728 cubic inches Pyramid = 1 cubic foot Pyramid.
15,625 cubic inches Pyramid = 1 cubic arm Pyramid.
1,000 cubic arms Pyramid = 1 cubic rod Pyramid.
1,000 cubic rods Pyramid = 1 cubic acre Pyramid.
15,625 cubic acres Pyramid = 1 cubic mile Pyramid.
64 cubic miles Pyramid = 1 cubic league Pyramid.[1]

Or—

Cub. inches.	Cub. foot.	Cub. arm.	Cub. rod.	Cub. acre.	Cub. mile.	Cubic league.
1,728 =	1					
15,625 = ... =		1				
15,625,000 = ... =		1,000 =	1			
15,625,000,000 = ... =		1,000,000 =	1,000 =	1		
... = ... =		15,625,000,000 =	15,625,000 =	15,625 =	1	
... = ... =		1,000,000,000,000 =	1,000,000,000 =	1,000,000 =	64 =	1

[1] There may at first be thought some inconsistency in the above introduction of "4," as 4 miles = 1 league; but there appears, on examination, to be a prevailing principle throughout the Pyramid system to finish off the largest items of any of its series in this manner, and thereby make the gross result more round, even, and commensurable with great things in nature. Thus one side of the Pyramid's base contains 9150 inches, an almost unmeaning, and certainly not a smooth quantity; but if multiplied by 4, and there *are* four sides of the base to justify this proceeding, it becomes 36,600, or, in lengths of a hundred inches, the all-important chronological symbol we have already expatiated on. Final multiplier of 4, in the Pyramid metrology.

Again, four capacity quarters make up the one inimitable coffer; the ton, or the weight-coffer, is also divided practically into four quarters; and if four miles are now said to form a league, such a league becomes instantly the neatest of all possible fractions of the earth's polar radius for employment in astronomy and geography; and it winds up with remarkable completeness the double-entry tables of linear, square, and cubic measures.

CHAPTER V.

HEAT.

Convenient heat-scale generally important.

As already shown, no system of weights and measures can be complete without a reference to heat, and its power of altering the dimensions of all bodies. It would appear too, that next to the very existence of matter, heat is the most important material element in creation; and, since the rise of the modern science of thermo-dynamics, which looks on heat as a form of motion, the measure of heat is the first step from statics to dynamics, which is the last and truest form of all science.

English thermometer extremely inconvenient.

A "thermometer" is therefore one of the most essential of all scientific instruments, and there is probably no science which can advance far without its aid; yet the thermometer in England is in a most unsatisfactory guise. It is even generally ridiculed over all continental Europe, as being inconvenient in practice,

and founded in error. In this idea foreigners are not very far wrong; for Fahrenheit's notion of absolute cold, is seen every winter to be utterly mistaken, whenever his thermometer is observed to be below zero; *i.e.*, his fanciful idea of zero: while the all-important point of the freezing of water is left at the very inconvenient number of 32°, and the boiling-point at 212°.

Fahrenheit's scale founded in error.

Many therefore have been the demands that we should adopt either the German Reaumur, or the French Centigrade; in terms of either of which, water-freezing marks 0°; and all degrees below that notable point, are negative; and above, positive.

Proposals for adopting Reamur, or Centigrade, scales.

The proposed change has, however, been resisted, because,

1*st*, The anomalous absolute numbers chosen for freezing and boiling on Fahrenheit's scale, do not interfere with the accuracy of thermometers so marked, when due allowance is made for them.

Objections made thereto.

2*d*, It has been against the principle of most British scientific men hitherto, in their different weights and measures, to have them showing a natural standard in themselves; but only to have their *proportion* to the said natural standards determined.

3*d*, This system has been carried out in its integrity

in Fahrenheit's thermometer when it is said, that 180 even subdivisions shall exist between freezing and boiling; and the commencing number for freezing shall be 32°.

British defence of Fahrenheit's thermometer, continued.

4th, In the fact that the distance between freezing and boiling is divided into 180 parts in Fahrenheit's thermometer, but only into 100 in the French thermometer, and 80 in the German instrument, great advantage is claimed for every-day purposes; because a greater number of different states of temperature can be quoted in even degrees, and without reference to fractions of a degree; and,

5th, It is said that the change would be subversive of all ordinary ideas of ordinary persons, as to what the new numbers really meant; because, what peasant would appreciate in his soul that a temperature of 40°, when a French system should be established, meant a summer heat of 104° Fahr.?

Defence weighed.

Some of these objections have weight, but others are of doubtful importance; and in all that can be said about the British scientific principle, as established by Government, not founding its measures on natural standards direct,—that has not only been well-nigh annihilated by the recent outcry of the commercial part of the nation for French units; but is proved to

be baseless in its early, and more than primeval, origin; by reason of the British length-unit, the inch, having been found, after all, to be an integral fraction of the earth's axis of rotation.

Defence of Fahrenheit's thermometer, refuted both by science, and ordinary practice.

The scientific men have too, in the instance of temperature, received a notable correction from the poorer classes of the land; the very classes for whom alone, all working measures should be primarily arranged; for every gardener, and probably every ploughman who thinks of such things at all, is accustomed to speak of the more *rurally* important and trying cases of temperature, not in terms of Fahrenheit's scale, but as so many "degrees of frost" or "heat."

Improvements required.

The practical importance, therefore, of having the British thermometrical zero, at the freezing-point of water, is thus incontestably proved, and from the right quarter; while, if it be desirable, as no doubt it is desirable, to have the space from freezing to boiling divided into a greater number of even degrees, than either the French or German systems offer,—why then, let the nation take for the space between the two natural water units, not the 180 of Fahrenheit, but the 250 of the Great Pyramid scale; for, by so doing, not only will they reap that one advantage above mentioned, and to a greater extent; but they will suffer less shock

Found in the Pyramid system.

as it were in their feelings, when talking of summer temperatures, than even if they retained the size of the Fahrenheit degrees, but placed the 0 at freezing—a fact which is simply illustrated by the following numbers, giving the same absolute temperatures in terms of five different thermometric scales:—

Fahrenheit.	Modified Fahrenheit.	Centigrade.	Reaumur.	Pyramid.
104°	72°	40°	32°	100°
122°	90°	50°	40°	125°

Crowning point of the Pyramid temperature scale.

But now, for the *finishing off* of this last temperature scale, strictly according to the Pyramid system, mentioned at p. 223. Multiply, therefore, the 250° of water-boiling by 4, making 1000°, and where are we landed?

At that most notable, and dividing, line of heat, where it causes bodies to begin to give out light; and registered with confidence by the Diffusion-of-Useful-Knowledge Society, in vol. ii. of their *Natural Philosophy*, p. 63, under title of "Iron Bright Red in the Dark," as 752° Fahrenheit; which amounts to 1000 degrees of the Pyramid precisely.

PART IV.

MORE THAN SCIENCE.

CHAPTER I.—THE SACRED CUBIT OF THE JEWS.

The smaller Pyramid linear standard; its essential nature.

REMARKABLE as is the assistance afforded to the grand Government survey of Great Britain, now in course of execution, by the smaller linear standard of the Pyramid (25 inches), it is likely to be found of service, and with peculiar power of adaptability, in other scientific operations as well. We have hitherto only spoken of it as the larger standard halved for practical convenience; but it is also derivable at once from the Pyramid, by taking that peculiar chronological fraction $\frac{1}{365}$th of *one* side of the base; a proceeding which has the further time-element in it of the four existing sides of said base, recalling to mind the cycle of four years, in the course of which the annual incommensurability, —or the time of rotation of the earth on its axis, with the period of its revolution in its orbit around the sun, —is practically restored.

Its scientific importance.

Moreover, the length which is procured in that manner, may be not so neatly, or we may say pyramidally, described as $\frac{1}{20,000,000}$th of the earth's axis, but as the $\frac{1}{10,000,000}$th of the earth's *semi-axis* or *radius* of rotation; and in astronomy distances are usually, indeed almost invariably, given by radii, and not by diameters of the various globes and orbits concerned.[1] The distance from the earth to the sun, for instance, is much more frequently under discussion, than the space separating the earth's position at six months' interval; or, again, in the question of stellar parallax, the distance from the earth, or sun, to a star,—not the distance of that star from another supposed star as far beyond our sun and system in one direction, as the real star is in another,—such a radial space, we say, constitutes the form in which the general problem is propounded and discussed by all mankind.[2]

In astronomical distance measuring.

[1] And certainly never, as in the boastedly scientific French system, in terms of portions of the *surface* of any globe whatever.

An improvable item of practice amongst astronomers.

[2] The distances of satellites from their primary planets are almost invariably given by astronomers, in their professional publications, in terms of *radii* of the said primaries; the moon's distance from the earth, for example, in terms of earth-radii. But what radii? Alas! in equatorial radii, which vary with the meridian, and are *not* the radii by which the said distance is determined.

In such observations it is always the Polar radius which is really employed, in whole or in part; by combining the meridian measures of Pulkova or Greenwich, as a high northern, and the Cape of Good Hope, as a southern, observatory.

Before many more years elapse, astronomers will certainly have to reform

Hence, although in the arrangement of a metrological system,—which started, as that of the Great Pyramid did, from the most important proposition in all the range of pure mathematics, and included within its compass the earth-ball as a whole, both in size and figure and weight,—it was right and proper then to deal with the larger standard of 50 inches; yet, in the greater number of practical operations, afterwards, even of the most highly scientific order, the smaller 25-inch standard is the one whose use is likely to be attended with the greatest amount of advantage.

The smaller Pyramid linear standard, compared with the sacred cubit of the Jews.

There is a further feature too, about this length of measure, which will constitute a most peculiar source of interest with some of the best minds in the world; viz., that not only is it in reality the representative or equivalent of the sacred cubit of the Jews, but it leads us to an understanding of *why* that length was styled the "*sacred* cubit," and to an appreciation of the reasons given.

Of cubits, generally.

The mere name of "cubit," mounts up the question at once to the beginning of human affairs in the world; for it is one of the earliest measures of which there is any notice; and has been therefore more used and abused, more copied, followed, and perverted than any

their mode of dealing with the size-measure of any globe of revolution, and follow both the teachings of the ancient Pyramid and the dictates of the practice of their own science.

Current Literary opinions on ancient cubits.

other. Its place of origin is of course the East, and according to Don Vasquez Queipo,[1] quoted with approval in Mr. Chisholm's Exchequer Report (1863), there was a threefold birth to the system. The primitive metrologies, says he, "were three in number, each distinct from the other, though preserving a perfect analogy in their combinations as well as in their bases. They were the Assyrian, the Egyptian, and the Phœnician. All the metric systems of other civilized countries, have been based on these three systems. The Hebrew system was a combination of all three."

From the Egyptians to the Romans.

He then goes on to describe how in Egypt, viewed by him chiefly in Roman times, there were again other three systems; the ancient one, of the Elephantine Nilometer and the Great Pyramid, which gave a cubit equal to 20·75 inches; the Olympic, founded on the Olympic foot, = 10·4 inches (and which system he says was adopted by "the Persians, Jews, Greeks, and Romans"); and the Ptolemæan system, in which the cubit was = 21·9 inches: and he adds, "this Egyptian system was also adopted by the Jews; the cubit of the Talmudists, which was that in common use, being equal to 21·87047 inches."

Without presuming to question the absolute accuracy

[1] *Essai sur les Systèmes Métriques et Monétaires des Anciens Peuples.* Par Don V. Queipo.

of the latter decimal places in the above statement, it may be enough for our purpose to remark, that even these later cubits, which are said to have been used by the Jews of those times, for common, not sacred, purposes, were quite of the metrical family of the most ancient cubits of Egypt; and a large number of these being actually collected, in more or less material form, by Sir Gardner Wilkinson, yielded 20·655 English inches as their mean length; the numbers varying from 20·57, the smallest, to 21·00, the highest.

All profane cubits circumscribed to narrow limits of variation from 18, to 21, inches.

Very similar to these, or practically identical with them, we conclude, and Don Vasquez would imply, those of Assyria and Phœnicia to have been, even at the earliest time. They are often said, to have had no other origin than the measured length, from a man's elbow to the point of his middle finger; but as that averages more generally between 18 and 19 inches,—and which actually was the length of the cubit when reformed according to verbal meaning, afterwards amongst Greeks and Romans,—we rather doubt that explanation.

According to Paucton, in his *Métrologie*, to Bailly, and Romé de l'Isle, the ancient Egyptian measures were founded on the Great Pyramid, one side of the base of which they would have equal to the $\frac{1}{500}$th of a degree of the meridian, "which had been previously

Old French theories on the Pyramid.

measured for that purpose." This is one of the astonishingly positive assertions ventured, without facts to go upon, and which had, years before Mr. Taylor looked into the question, brought not unmerited suspicion on any metrological theory connected with the Great Pyramid; and caused all allusions to it, in that capacity, to be stigmatized as "a mystical origin of weights and measures;" for it implied the unproved existence, at a former age of the world, some thousands of years before Greek or Roman civilisation, of a people scientific, and literary, exactly up to the point of the nation of the modern European propounder of the theory, and endued with all his learning and crotchets, but not one step more; and then their complete erasure from the tablets of tradition, history, architecture, and geography.

Productive of "mystical" ideas in metrology.

Baseless, and visionary.

Fortunately, there is no occasion for our going into this dispute, nor into the paltriness and scientific insufficiency of the old French, and perhaps in some quarters, the modern English, idea, of a fraction of a degree of the meridian, as a natural reference, for a unit of linear measure; because, while those older authors had no exact knowledge of what the real dimensions of the Pyramid were, they never attempted, or desired, to show, that the primitive Egyptian cubit,

But leave the length of profane cubit, untouched.

or the cubits of any of the profane Eastern nations, were materially different in length from the 20·74 inches of the well-known cubit scales.

Profane cubit, is distinguishable by a certain length, and that length not evenly earth-commensurable.

Now, that being a length which is wretchedly incommensurable with the one, and only, true reference for linear measure, viz., the earth's axis of rotation, it cannot commend itself to scientific men in the present day: and further, it is a very sensibly different length indeed from what we have now to inquire into, viz., the *sacred* cubit of the Jews.

Sir Isaac Newton on cubits.

Our chief authority on what the length of that extremely important measure may have been, is most fortunately, the illustrious Sir Isaac Newton himself. His paper, entitled "A Dissertation on Cubits," is in every way a most valuable and powerful production; and he indicates there pretty clearly, that in one part of the East, and where the earliest revelations from God to man took place, a decidedly larger cubit than any of the above was traditionally known, and most earnestly preserved, treasured up, and obeyed, among some very limited branches of the House of Shem. The exact date of its promulgation he does not attempt to fix, but alludes to the certain fact, of its having become the "proper and principal cubit" of the Israelites, *long before they went down to Egypt.*

On the "proper" cubit of the Israelites.

Which is also their "sacred" cubit.

Now, the size of this remarkable cubit, and which seems eventually to have remained in the sole possession of the Jews, and to have been, after the Egyptian captivity, employed by them for sacred purposes only, Sir Isaac attempts to ascertain in various modes, as thus:—

Sir Isaac Newton's method of successively approximating to its length.

1*st*, By means of Josephus' accounts of the circumference of the pillars of the Temple, both in cubits and men measures, he fixes it as being above 2, and under 2·4 of a Roman foot,[1] = 23·28 and 27·94 English inches.

2*d*, By considerations on the length of the Jewish Sabbath-day's journey, and also the size of the steps leading to the inner courts, it is further circumscribed within the same, or somewhat smaller, limits.

3*d*, By comparison on certain indicated proportions with the cubit of Memphis,—as greater than 25·57, and less than 25·79, unciæ of the Roman foot, = 24·80, and 25·02 English inches.

4*th*, By means of a cubit supposed to have been copied from a model secretly preserved by the Jews, and received through "Mersennus and the illustrious Hugenius, Knight of the Order of St. Michael," = 25·68 Roman unciæ = 24·91 English inches. And,

[1] On the mean determination by Raper, Wurm, Picard, Greaves, and Shuckburgh, that 1 Roman foot = 12 Roman unciæ = 11·64 English inches.

5th, By the proportions adopted by Josephus in reducing Jewish sacred cubits to Roman cubits, making 24·82 English inches. Concludes, but not finally, for a length of 24·9 inches.

But Sir Isaac does not consider any of these determinations positive and final, and he rather refers the full fixing of the length to some subsequent day, when men shall have "measured and compared together with greater accuracy more dimensions of the stones" in the Pyramid, the Temple of Jerusalem, and certain other ancient buildings. This remark was prophetic, almost of Mr. Taylor's recent researches; for out of further measurements of the Great Pyramid, has come out a standard of length, of 25 even inches; so close to Sir Isaac's approximate determination of the Jewish sacred cubit, that we cannot but regard them both as meaning the same thing: especially when taking account of the tendency of wooden, and wrought metal, scales to slightly shrink in length during long ages; and to the old traditional account of this cubit having been once engraved on the walls of Susan and Babylon, and having been subsequently found by the Talmudists very sensibly longer than their own slowly shortening, but highly regarded, rod; for this effect abundantly explains the missing tenth of an inch on Mersennus's measure. Hence the true length of the sacred cubit

Probably too short by 0·1 inch.

True length, 25 inches.

of the Jews, must undoubtedly have been 25 Pyramid inches; and in that case, it represented an even $\frac{1}{10,000,000}$th of the earth's polar semi-axis.

Sacred cubit, distinguishable, by a length quite outside all the profane cubits; and by being admirably earth-commensurable.

Sir Isaac Newton had no idea of this important relation to the whole earth, of the numbers which he was, by his successive discriminating steps, so securely approximating to. Indeed, his only expressed idea, as to Pyramid measures in particular, was, that they would bring out the Egyptian, or Memphis, cubit; and this they will do, as their first result, from some of the external, and necessary, structural, parts of the edifice; but merely indicate thereby, what were the national measures of the people, who were employed against their will and in spite of their own religion, to do the drudgery of the labour of the Pyramid; and who were never allowed to know the ultimate object for which their work was to be employed. The Egyptians, indeed, were as bees, working laboriously, bit by bit, according to the will and fiat of the Great Architect; of whose pleasure alone it comes, that their ultimate results present waxen cells of a hexagonal and scientifically perfect form, to the admiration and instruction of generation after generation of human beholders.

Egyptian workers at the Pyramid, ignorant of its end and aim.

There may seem at first something strangely cruel, in this obligatory service which was insisted on, without

its being qualified even by an imparting of the why, or wherefore, of all the compulsory labour. Yet there do appear no slight justifications. It was necessary to plant the Great Pyramid in Egypt, both on account of its latitude (p. 65), and the gaining of certain physical conditions (pp. 158 and 168), not procurable elsewhere in the same parallel. But the Egyptians had already scornfully taken their own human way in the world. They had been told, like Cain, "a sin-offering[1] lieth at the door," an appointed means of grace and favour. Nevertheless they refused to profit by it; their countenance remained wrathful and fallen; and they even banded themselves together to consider the divinely appointed means of reconciliation "an abomination unto them."[2] Worse still, they chose to them other gods; and what gods! and bound themselves over to do honour unto them, as even their own historian relates in these words:—"King Cœechos reigned thirty-nine years. Under him the bulls, Apis in Memphis, and Mnevis in Heliopolis, and the Mendesian goat, were appointed to be gods."[3]

The Egyptians had placed themselves out of the pale of communication, for all true and holy ideas.

The gods they had made to themselves.

[1] In the authorized translation, there is the unfortunate error, of inserting "sin," in place of "sin-offering;" which alters the whole sense of one of the most important and resultful passages in the Bible.

[2] Mr. Taylor's *Great Pyramid*, p. 217.

[3] Manetho's Dynasties, in Cory's *Ancient Fragments*.

Egyptian idolatry began before the building of the Pyramid.

This happened under their second dynasty, some 200 or 300 years before the founding of the Great Pyramid; at which time, from the steady increase that went on, ever after its first establishment, in the Egyptians' degrading idolatry, that people must have been then immovably rooted in false prejudices, and utterly incapable of appreciating the pearls laid before them. Their compelled labour, therefore, at the Pyramid, was but a judgment for their sins; and yet it was fully made up to them in kind, afterwards, and from the same High directing quarter, by the amount of similar labour they were allowed to exact from the Israelites.

Their labour repaid to them.

Ordinary character of the mere external features of the Pyramid.

If the veil of the Pyramid, however, is now beginning to be removed from our eyes, the veil that prevented even a Newton from seeing further than the outside surface, we are taught the necessity of more than ever searching through and beyond the primary, for the secondary, and vastly more important, phenomena of the Pyramid.

Extraordinary character of those, which afterwards came to light.

Thus the measurings performed on the actual edges, and flanks of the Pyramid, never told anything particular; but when Mr. Taylor led us to consider the vertical height, a central and intangible line, only to be got at by calculation from the outside parts,—the first wonder of the structure was touched on. Following up

this view, by studying the squared area of the vertical meridian section, a something in itself more intangible still, the arrangement of all the passages was arrived at.

The Pyramid passage first met with, not the really important one.

Of these passages again, the lower and ostensible one, was the least important of the whole; for the real secrets of the Pyramid lay with the upper ones, concealed through 3000 years; and with these upper ones, the first measures which are obtained by actual application of the foot-rule, are not the things ultimately meant.

Sir Isaac Newton saw some very distinctive features between the sacred, and profane, cubits.

Sir Isaac Newton lived too early to be aware of all these things; but he had a vision sufficiently beyond his own time to see, that that first result of the measures, or the cubit of Memphis, in terms of which the passages were immediately built, and practically put together; and which cubit has no such scientific relation of earth-commensurability as the sacred cubit has,—was to be looked on in a very inferior light; for he almost stigmatizes the Memphis measure, as the "profane or adventitious cubit;" as the cubit of a man; and a thing only used by the Jews for coarse operations and week-day work.[1]

[1] See Deut. iii. 11, where it is employed in indicating the dimensions of the impious King of Bashan.

But why, it may be asked, did they employ two measures so near each other, as the sacred, and profane, cubits?

Sir Isaac Newton explains why the Jews with the sacred cubit, learned to use another cubit.

Sir Isaac Newton's explanation is lucid and satisfactory to a degree, for every practical man. "They, the Jews, brought," says he, "their own sacred measure to Egypt with them; but living for above two hundred years under the dominion of the Egyptians, and undergoing an hard service under them, specially *in building, where the measures came daily under consideration,*—they must necessarily learn the Ægyptian cubit. Hence came the double cubit of the Jews, viz., that of their own country, and the adventitious one, which, from its being used on ordinary occasions only, was esteemed vulgar and profane."

Captivity in Egypt.

During that sad period too,—of near four hundred years according to some chronologists,—of national slavery to the hardest of task-masters, the Israelites got inevitably into the way of using something else, besides the measure of length of the Egyptians; for they adopted *their* mode of measuring time, and of telling off the days, first by lunar, and then by solar, months.

Its effects on the Jews, in their measures of time also.

Now these things very frequently go together, viz., measures of time and measures of space, in ancient as

well as modern history. The accompaniment was eminently seen at the French Revolution in 1792, when the then new metrical system was introduced along with a new calendar, giving new names and lengths to all the months, abolishing the week, and substituting in its place a decade or period of ten days, of which every "decadery" day was to be kept as a secular festival; and finally, indicating by facts,—for the Christian faith was on that occasion formally abolished in France, as well as the Sunday and week of seven days,—that there is a third thing which usually stands or falls with hereditary measures of time and space, viz., *religion*.[1] But at the period when Moses took the direction, under Providence, of his down-trodden countrymen, they had most probably well-nigh lost all traces of their nationality, which was their religion too, in these arrangements. They had come in fact to think, as well as to work, in the profane terms of their masters.

Measures of time and space, frequently go together.

Moses took cognizance for the Jews of a sacred measure, both of space, and of time.

But whatever unsanctified plans a period of many centuries had made almost a second nature to the captive Jews in the ordinary affairs of life, their great

[1] For an excellent and readable account of the chief features of the French decimal chronological system, see Chambers's *Handbook of Astronomy*, 1861.

leader Moses determined they should not bring anything of the sort into the service of the living God.

Of the foundation of the sacred character of the measures advocated by Moses.

There, accordingly, he insisted, in the matter of time, on the most strict observance of what we know, from other sources, was the Divine appointment of a week of seven days; and in the affair of space, or length, or linear size, he insisted also on what *he* seemed to think, and what he succeeded in impressing on his countrymen to think also, during more than 2000 years after him, was a divinely appointed measure of length; and one which, according to Sir Isaac Newton, they had received in days long anterior to any of their race having ever been down into Egypt; viz., the sacred cubit of 25 inches.

Mr. Taylor the first to give the explanation for the space measures.

Why, in a physical and scientific sense, a measuring-rod of 25 inches should have a very superior character about it over one of 20, or 21, or any other near number of inches or portions of inches, we suspect that no man alive had any notion of, before Mr. Taylor indicated, from his "sacred" point of view of the Great Pyramid, its integral earth-axis commensurability; giving thereby an instance of the highest and truest science, being found wedded with the purest and best of religions.

Yet the discovery, when once published, appears so

very simple, that one wonders it was never made before: especially as the above statement, by itself, wants no Pyramid theory or measures to prove it, but merely, on one side, the given length of 25 inches, and on the other, the results of trigonometrical surveys and "arc" measures of the earth, such as have been performed by various nations.

Strange that Mr. Taylor's discovery was not made by others long ago.

But the performers have seldom or never reduced their measures to inches, which would have shown the commensurability at once; and the reason why they did not do so in this country was, the somewhat anti-Christian doctrine of the rich men abandoning the hereditary national *unit* of measure, the inch, because it was conveniently the poor man's unit, and striving perpetually to introduce their own huge unit, the yard, a thing which nature does not acknowledge.

We have looked over the various reports of Parliamentary commissions and Government referees on standard weights and measures from 1824 up to 1863, and can find not the smallest symptom of the real merit of inches, singly or in standards of 25 and 50, being perceived or appreciated therein. The main object is, to make the yard the unit, and swamp both the inch and all reference to the earth. Hence, when the Astronomer-Royal reports on February 1, 1859, the erection

Proofs that said discovery was unknown in Government and Parliamentary quarters.

Earth-incommensurability of certain new British linear standards.

of certain public standards of length on the external walls of the Greenwich Royal Observatory, and when it had been found absolutely necessary, from the demands of the working poor, to have some smaller standards than the rich man's great unit of 36 inches,—a series of lengths was chosen, and established by the public money, which one would think almost studiously selected to prevent any one of the number showing an integral earth-axial relation, the series being 36, 24, 12, 6, and 3 inches.

Opposed to the religious feeling of the country.

Yet, although some of the most learned men of this country have unfortunately been preaching for half a century, the non-importance of earth-commensurability for our units or standards of measure,—and although their efforts in this way, constantly becoming bolder and bolder, have attained to a bad culmination within the last few years,[1]—happily the instinctive and semi-religious feeling of the bulk of the nation has been against them. They, the learned men, had pretty well succeeded, by combining with Government and Par-

[1] "The Act, moreover (of 1855), which constituted that one our legal yard,—omitted the clause identifying its length with any numerical multiple of the pendulum. In fact, then, our yard is a purely individual material object, multiplied and perpetuated by careful copying, and from which all reference to a natural origin is studiously excluded, as much as if it had dropped from the clouds."—*The Yard, the Pendulum, and the Metre.* By Sir J. Herschel, Bart., 1863.

liament, so to modify and artificialize the hereditary British system, that other men began at last to think it *perfectly* artificial, and without any superior or higher guiding principle than merely the effects of chance, and the results of man meeting with man, in the daily toil of life.[1]

Unsatisfactory character of mere chance, and human-practice, conclusions.

But this would be a barren world, my masters, had that been the case; for man has a soul, and yearnings of the spirit after a higher power, and he loves to see traces, however moderate, of the rough-hewn work of his own hands, being shaped insensibly towards a nobler end, than at the time he had any conception of. Hence, even in spite of what was taught by the autocrats of British science, there were some of their hearers, faithful men in the land, who would persist in feeling a superior pleasure, and having an extraordinary content of mind, in looking on a scale which, like the sacred cubit of the Jews, represented an integral fraction of the leading features of the earth-ball created by God; than on another scale, of not very different length, but which, like the profane cubit of the Egyptians, was merely a convenient scale, accidentally originated, for

Scientific teaching, and religious instinct at variance.

[1] "It is to be presumed that in mere retail matters, mankind have, by almost infinite practice, fixed on what they like best."

"It appears to me that the *practice* of mankind as regards their selection of," etc. etc.—*Parliamentary Metrological Paper*, April 1862.

some rich man, whereby or wherewith to measure his possessions, and estimate the treasures he had accumulated to himself in this transitory life of pain and sin.

Marked failure of all the Government enactments.

There has been much lamentation of late over the stubbornness of the British people, and their contumaciously defeating all the well-intended legislative enactments of the Government, for promoting uniformity of weights and measures through the country; but the fault is eminently with the Government itself; and they may rest assured, that so long as the principle

Probable reason.

which they advocate, and try to oblige the people to follow, is the principle,—as irreligious as it can be in metrology, and unscientific too,—of hap-hazard measures of a size to serve the rich and puzzle the poor, and lead no one to higher and nobler thoughts, they never will see a successful establishment of uniformity of weights and measures in this earnest, and most truly religion-appreciating, country.

Illustrated by the too favourable reception of the French metre, in a British Parliament.

When the French metre was proposed the other day in the British Parliament to replace the British yard as the national measure of Great Britain, and was received by a large party with acclamation,[1]—a very considerable portion of that favour was due, without doubt, to the said metre having a something about it

[1] See *Times* newspaper, May 1863.

superior to merely being a rod of brass so many inches in length; to its having in fact some sort, though a very indifferent sort, of earth-commensurability; and to the professed French atheists being, after all, less deadly and unmercifully atheistic in their metrological preparations for the people, than some very learned and creditable Englishmen in the neighbourhood of London.

First symptom of a break-up in the accustomed routine.

One of the Government *savants*, however, has been acute enough to see the weakness of the British system, as represented by recent legislation; and has, within the last few days, published a defence of it from a totally different point of view from what he has ever advocated before, even in the course of a long life devoted to science; for he now contends, that the *inch* is the true British unit; and being earth-commensurable in the best way, or with the axis of the earth, is therefore better than the French scale, which merely refers to part of the surface.[1]

Ideas derived from Mr. Taylor.

But here, even this new-born advocate of the ancient Pyramid teachings, copying from, though not acknowledging, Mr. Taylor, has failed in the better half of what he ought to have said; for he leaves the stated

[1] "This is a blemish on the very face of the system,—a sin against geometrical simplicity."—H.

qualities of the British inch, as merely an affair of pure accident; and if it had been only that, how could the hearts of religious men warm towards such a result? Marks of intention, and purpose, on the things of this world, are what chiefly sanctify them in the eyes of good men; and such features do pervade the Great Pyramid in its every part, and teach us something very different from this accidental theory, of what the British nation, as a nation, has *inherited* in the inch. And by means of that *inheritance* alone it is, and not by anything that their hosts of scientific men have done, that the British people need not to-day stand ashamed in the face of all the learned of Europe, in a question of their metrology discussed in the light of day, and tested against the most advanced systems of other nations.

But imperfectly related.

How much further should we have been advanced in this subject, had our countrymen from an early period looked on that magnificent record of the primeval days of mankind, the Great Pyramid, from a more truly religious and Christian point of view,—than when they rushed headlong into the desire to know more about the sanctified bulls, and cats, and crocodiles, and Ibises, and all the other unholy holies of that impure Egyptian nation, than ever did the Egyptians themselves,—a people positively abhorred by the Romans of

Lowering effect of the ordinary Egyptian studies.

the Pagan Empire, for their repulsively low ideas of human nature?[1]

Pure feelings, of a pure mind, on beholding the Great Pyramid.

Freed from these perverting prejudices, of being wise in old idolatry, how rise in noble aspirations, the thoughts of any fair, honest mind, on merely beholding the external mass of the Pyramid! Thus writes a recent traveller, a plain and simple style of working man, but with the feelings which spring from Christian education and the improving sentiments it teaches,—thus he writes, without however, as might be expected in a stranger, sufficiently distinguishing the Great Pyramid from the others in its immediate neighbourhood:—

The venerable age of the Great Pyramid.

"To view them merely as gigantic monuments is a novelty productive of impressions of sublime grandeur, of which words fail to convey any accurate conception; but when they are further viewed in connexion with the history of the human race, as older than the oldest records, and marked with the antiquity of those ages long gone by, when the earliest of the patriarchs entered Egypt, the mind becomes absorbed, and I felt as though I could have lain, not for hours only, but even for nights and days, indulging in the sight of the greatest of these Pyramids." "With the Jews, to look back beyond the time of Abraham was deemed a

[1] See Juvenal's Satires.

glimpse of eternity; and the passage, 'Before Abraham was, I AM,' is at once presented to the mind in connection with this view. Yet even in Abraham's time it is supposed that these Pyramids were works of venerable antiquity."[1]

Enshrines the same sacred cubit, which the Jews had received as such, *before* they went down to Egypt.

True, most true; and in the Great Pyramid we have found enshrined, and sealed up, from those pre-Abrahamic to these latter days, that identical sacred measure of space of the Jews, which, according to Sir Isaac Newton, the leaders of their race had received *long before they went down to Egypt.*

Is it possible, then, may we ask, that any allusion to the earliest *written* Divine command, the measuring of time by a week of seven days, may be found there also? It is not necessary to the metrological systems proper, that it should be; but if it does exist, even to ever so limited an extent, it must immensely strengthen the argument of intention and purpose in the origin of what our nation has so happily *inherited;* and indicate something of the High quarter, whence an inheritance, so similar to one of the sacred gifts to the *peculiar people,* primevally came.

Does the Pyramid contain any allusion to the sacred division of Time?

[1] *Notes on Egypt,* by T. Sopwith, C.E. Privately printed.

CHAPTER II.

TIME MEASURES IN THE PYRAMID.

A more particular research into the nature of the passages in the Pyramid.

IN this important question, of whether there are, or are not in the Great Pyramid any indications of the week, or the sacred standard of 7, day-units, in the measure of time—we shall have to consider more closely than we have done hitherto, the various passages contained in that gigantic edifice. They are exhibited as a whole, in our former Plate V.; while in our present Plate XV., such portions of them as are contained in the *lower half of the northern side* of the former view, are drawn to a larger scale, and according to our geometrical hypothesis of them, only; the numerical data on which the diagram is constructed, being as follows:—

Semi-base of Pyramid, ...	= 91·5 metrons.
Height of Pyramid, ...	= 116·5 „
Semi-side of square, of equal area with Meridian section, ...	= 51·624 „
One-half semi-side of above, . . .	= 25·812 „
One-third semi-side of above, . . .	= 17·208 „

Angle of altitude of lower culmination of ancient Pole-star, ...	=	26° 18′
Place of Pole at the Pyramid, . . .	=	30° 0′
Upper culmination of ancient Pole-star, . .	=	33° 42′
Angle of Equator at the Pyramid, . . .	=	60° 0′
26° 18′, tangent of, with radius of 91·5 metrons	=	45·222 metrons.
30° 0′, tangent of, with radius of 91·5 metrons	=	52·828 „
33° 42′, tangent of, with radius of 91·5 metrons	=	61·023 „
60° 0′, tangent of, with radius of 91·5 metrons	=	158·482 „
Transverse height of a small passage, .	=	44·8 inches.

The above quantities similar to those previously employed; only further developed.

These quantities are all very similar, indeed so far as they go, identical, with those arrived at, and employed in Part I. Chap. v., Plates III. IV. V.; but more care has been employed in laying them down on paper; the angles by their computed tangents, and the passage breadths, according to the measure given above; one-half of it being disposed on either side of the central theoretical line. With the slight exception, too, of the upper well, which is not of a very regular figure, and is known only through travellers' accounts,—the other features are put in entirely according to the same hypothesis which was commenced in Part I. Chap. v., and is here merely carried on somewhat further; being found to be capable, without addition or alteration, of giving the shapes and sizes of some of the smaller as well as most of the larger, features of the interior of the Pyramid; witness the escarpment at the lower end, and the tall step and passage, at the upper end, of the Grand Gallery.

Large general agreement between hypothesis, and fact.

That there is a real hypothetical construction ruling throughout our Plate XV., will evidence itself to any one who looks closely into it, by an intersection of two or more of its lines, being found at any place to which, or upon which, any of the passages or other interior formations of the Pyramid have been drawn; and that such intersections of the hypothetical lines, do really come very close to what obtains in the Pyramid itself, may be seen by running the eye down the following list of very respectable, but by no means infallible, admeasurements, given by Colonel Howard-Vyse, and the corresponding places measured on our Plate XV.:—

NAME.	Size by Col. Howard-Vyse. Inches.	Size by Plate XV. Inches.
Entrance passage; from original commencement, to junction with ascending passage, . "More than"	1034	1140
Total length of inclined entrance passage from original commencement, . . . "More than"	4126	4140
Depth from base of Pyramid to floor of Subterranean Chamber, ...	1226	1280
Ascending passage, length, . . .	1492	1460
Grand Gallery, to upper step, . . .	1810	1790
Grand Gallery, total length, . . .	1872	1860
From base of Pyramid to surface of step, .	1675	1670
From North end of Grand Gallery to beginning of low passage to Queen's Chamber,	199	200
The low passage to the step, . . .	1104	1060
From the step to the Queen's Chamber, .	215	190
From base of Pyramid to floor of long passage leading to Queen's Chamber, .	830	830

Passages are most intimately connected with various astronomical data.

The conclusion which we apprehend should be drawn from this remarkable general agreement of the two sets of numbers, in all cases from sizes of 200, up to 4000, is merely this,—that the data on which our hypothesis is based, viz., the height and base-breadth of the Pyramid, with the astronomical angle of latitude, and the Pole-star culminations,—have been almost everything in deciding the sizes, angles, and positions, of the internal passages of the Great Pyramid.

Why were such data followed?—

Yet then comes up the mightier question, *why* were they made so? and *why* did the builders subject themselves to all the inconveniences of such data; and construct *most* of the passages so excessively low, that a man can hardly pass through them, even bending on his hands and knees; and *one* of them again so unconscionably high, as is the "Grand Gallery," that the blazing torches of the Arab guides seldom suffice, in its mere darkness made somewhat visible, to show the ceiling to wondering visitors?

Even to producing extravagant differences of heights.

We are not aware that any approach to a sufficient answer has yet been given anywhere; and all that violent, and apparently unreasonable, contrast of heights, remains the most mysterious thing in its origin, at the same time that, in its existence, it is one of the best ascertained facts about the whole of the Great Pyramid.

French confession of a mystery, not yet explained, in the various passages of the Pyramid.

The French Academicians enlarged much and learnedly on the circumstance; but could neither solve that, nor many other points, about both the Gallery and the smaller passages. Almost in despair at last, but the despair of an honest and well-read man, unashamed to confess the truth that such a case was too difficult for him,—M. Jomard exclaims, at p. 198 of *Description de l'Egypte:* "Everything is mysterious, I repeat it, in the construction and distribution of the monument; the passages, oblique, horizontal, sharply bended, of different dimensions!" And again, at p. 207 of *Antiquités Mémoires:* "We are not at all enlightened either upon the origin, or the employment, the utility, or any motive whatever, for the gallery and various passages of the Pyramid; but do we know anything more either about the wells, or much rather about the 28 (and 26) square holes or small cavities worked with skill along the sides of the high ascending gallery?"

First results from a close examination of the passages.

Where so many great men have failed, we must proceed with caution indeed; and commencing therefore at the very beginning, with what has been known to and confessed by all men for ages, we will, at present, merely call attention to the extraordinary pains that were taken by the original builders with the structure of all these passages.

Professor Greaves' praise of the entrance-passage.

Even with the first, or entrance passage, the most used and abused of the whole, both in mediæval and modern times, and the most sacrificed by the ancient builders to structural requirements,—yet the regularity and beauty of its fabric seems to have been ever the admiration of all beholders. Professor Greaves, in 1638, exclaims, with almost a touch of the Tennysonian feeling of 1860, on beholding this passage some 4000 years after its builders had been laid in the dust, and their spirits had returned to God who gave them, "the structure of it hath been the labour of an exquisite hand."

Yes, indeed; but to bring back the "tender grace of a day so very long since dead," how vain it would be merely to sigh

> "for the touch of a vanish'd hand,
> And the sound of a voice that is still."

Its mechanical points of excellence.

Nor does the Savilian Professor abandon himself to vain regrets; but goes on methodically to describe the mechanical elements of the excellence which he had noted; such as, "the smoothness and evenness of the work, the close knitting of the joints," and the accuracy with which the exact breadth of 3·463 of the English foot is kept up through a length of 92·5 feet. But when he comes to the portion of side-passage forced by Caliph Al Mamoun, he describes *that*, as "a place

somewhat larger, and of a pretty height, but lying incomposed; an obscure and broken place, the length 89 feet, the breadth and height various, and not worth consideration." And again, "by whomsoever (among the moderns) it was constructed, is not worth the inquiry; nor does the place merit the describing; but that I was unwilling to pretermit anything, being only an habitation for bats, and those so ugly, and of so large a size, exceeding a foot in length, that I have not elsewhere seen the like."[1]

Characteristics of Caliph Al Mamoun's forced hole.

When, on the contrary, he reaches the first ascending passage of the ancient builders, a passage of the same breadth, nearly, as the entrance or descending passage,— he then writes: "The pavement of this rises with a gentle acclivity, consisting of smooth and impolished marble, and, where not smeared with filth, appearing of a white alabaster colour; the sides and roof, as Titus Livius Burretinus, a Venetian, an ingenious young man, who accompanied me thither, observed, were of impolished stone, not so hard and compact as that of the pavement, but more soft and tender."

The first ascending passage, its beauty of material.

And then when he arrives in the far freer and open space of the second ascending passage, or the grand gallery, he speaks of it as "a very stately piece of

[1] Murtedi, an Arabian author, says, "As big as black eagles."

The height and majesty of the Grand Gallery.

work, and not inferiour either in respect of the curiosity of art, or richness of materials, to the most sumptuous and magnificent buildings." And again, "this gallery or corridor, or whatsoever else I may call it, is built of white and polished marble, the which is very evenly cut in spacious squares or tables. Of such materials as is the pavement, such is the roof, and such are the side walls that flank it; the coagmentation or knitting of the joints is so close, that they are scarce discernible to a curious eye; and that which adds grace to the whole structure, though it makes the passage the more slippery and difficult, is the acclivity and rising of the ascent. The height of this gallery is 26 feet; the breadth 6·870 feet, of which 3·435 feet are to be allowed for the way in the midst, which is set and bounded on both sides with two banks (like benches) of sleek and polished stone; each of these hath 1·717 of a foot in breadth, and as much in depth."

Of the two long "ramps;" and the numerous, carefully cut, holes therein.

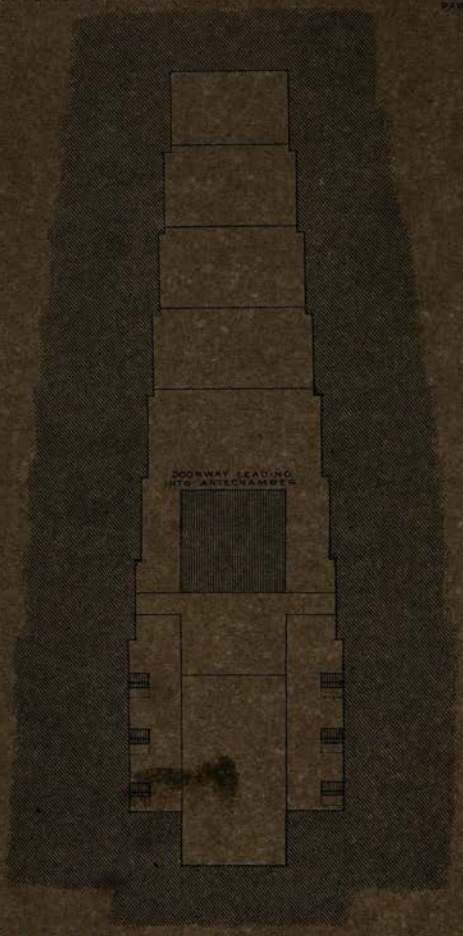
"Upon the top of these benches, near the angle where they close and join with the wall, are little spaces cut in right-angled parallel figures, set on each side opposite to one another; *intended no question for some other end than ornament.*"

"In the casting and ranging of the marbles in both the side walls there is one piece of architecture, in my

PLATE 16.

VERTICAL CROSS-SECTION OF GRAND GALLERY

PART 4. CHAP 2. P. 281



PYRAMID INCHES 100 90 80 70 60 50 40 30 20 10 0

100 PYRAMID INCHES

judgment very graceful, and that is that all the courses or ranges, which are but seven (so great are these stones), do set and flag over one another about three inches; the bottom of the uppermost course oversetting the higher part of the second, and the lower part of this overflagging the top of the third, and so in order the rest as they descend. Which will better be conceived by the representation of it to the eye, as in Plate II. Fig. 2, than by any other description."

Of the seven overlappings of the marble walls.

Unfortunately in Dr. Birch's edition of Greaves in 1737, although he alludes to his book being "adorned with sculptures," and "illustrated with cuts by a curious hand;" the plates are so very indifferent, that we have preferred to supplement his cross section of the Grand Gallery, by the following modified copy, from the French *Description.* (See Plate XVI.)

See Plate XVI.

The subject is not easy to represent fully and well, on account of the strange rise in the floor-level, and is more difficult still in a perspective view; yet M. Cécile succeeded in making two very striking pictures for Plate XIII. of vol. v. of the French work, and they should be sought up in the original, rather than in any copy, to realize the full effect of the strange scene.

Notable French engravings of Grand Gallery.

To come, however, from these generalities, to the hard matters of number, by which all our conclusions

Of the measure by which the gallery was built.

must be tested at last,—Sir Isaac Newton showed very clearly in his day, from Professor Greaves' measures, that the breadth of the *small* passages was "equal to two cubits of Memphis, or 41·4 inches:" accepting which determination we may also add, that the transverse height, though stated by some observers "to be the same," is probably not so, but is rather = 44·8 inches.

This result is deduced from the following tabular

SMALLER PASSAGES OF GREAT PYRAMID.

Authors.	Name of Passage.	Angular Position.	Breadth.	True, or Vertical Height.	Vulgar, or Transverse Height.
			Inches.	Inches.	Inches.
Greaves, . .	Entrance, . .	Descending, .	41·316	..	..
Howard-Vyse,	,,	,,	41·5	..	47·0
,,	First ascending,	Ascending, .	41·5	..	47·0
,,	To Ante Chamb.	Horizontal, .	41·5	44·0	44·0
,,	To Queen's Chamber, . .	,,	41·5	46·0	46·0
,,	Same beyond the step,	,,	41·5	68·0	..
M. Jomard,	Entrance, . .	Descending, .	43·2*	..	68·0
,,	First ascending,	Ascending, .	43·2*	..	43·2*
,,	Ante-Chamber,	Horizontal, .	41·3†	43·7	43·7†
,,	To Queen's Chamber, .	,,	43·2*	43·2	43·2*
Caviglia, .	Entrance, . .	Descending, .	42·0	49·0?	49·0?
,,	To Ante Chamb.	Horizontal, .	41·0	43·0	43·0

view of measures by different observers; the greatest weight being given to Colonel Howard-Vyse amongst all observers; and, amongst his measures of height,

* Reduced from French measure, in proportion of 1 French inch to 1·066 English inch.

† Reduced from French metre, in proportion 1 metre = 39·37079 English inches.

the chief place being allowed to his determination of the two horizontal passages; for there, the vertical height, or height proper, coincides with the transverse height, which would appear to be the actual element usually given by most observers, simply, but erroneously, as "the height."

Of the variation amongs observers.

From the great variations amongst these measures, it might at first be supposed that the passages themselves are very various in height; but as some of the authors speak with admiration of the astonishing evenness of the work, we are rather inclined to attribute the differences mostly to errors of scale, and difficulties of measuring in a dark place; and do trust that the chosen quantity, 44·8 inches, is very close to being the real transverse height of all the chief of the small passages. Yet even if that be granted, we have still therein a "profane" quantity, for it may be considered as being two Egyptian cubits and a palm (or 41·4 + 3·4). But then comes into play that strange inclination given to almost all the passages, viz., close on 26°, or, as our diagrams have already determined it, 26° 18′.

True height of small passages;

Effect of the inclination of 26° 18′.

This inclination, if ever explained hitherto, has been considered an astronomical feature; and we would not wish to disturb it from that position in the least, but to leave unquestioned Sir John Herschel's masterly deter-

Astronomical foundation for the angle:

mination, that the entrance-passage of the Pyramid did once look out on the lower culmination of the Pole-star of 4000 years ago;—an opinion further confirmed by the conclusions of the French philosophers.[1] That one fact, however, does not by itself establish, that the Pyramid was intended merely for an astronomical observatory; and we fear that astronomers must dismiss that favourite and frequently-published notion of their own shop, from the desires of their hearts: for, seeing that the passage was closed, immediately after the building of it, by a large stone portcullis, raisable only with immense difficulty, and on some few special occasions, its opportunities for observation would certainly have been far too rare, to satisfy the practical needs of a working observatory.

Yet Pyramid not built for an astronomical observatory.

Metrological effect of the angle, on the height of small passages.

There is, moreover, another reason for the angle existing there in a merely passive state, and in the particular proportions which it is found to possess; and it is no other than this, viz., that at an angle of 26° 18′, the *transverse* height of 44·8, becomes a *vertical* height of 50 inches; or, that a measure in which the Egyptian workmen could see nothing more than some of their profane

[1] So far as we can ascertain, they compared their observations only with the rough outside of the Pyramid. But what noble nation will lift up the portcullis-block, which still stops the entrance to the first ascending passage (see Plate XI.), and test the orientation of the finished galleries, and more especially of the Grand Gallery in the heart of the Pyramid?

cubits and palms,—is converted by means of that angle, into another indication of the grand linear standard of the Pyramid; or the $\frac{1}{10,000,000}$th of the Earth's axis of rotation. There is consequently in the vertical height of the smaller passages of the Pyramid, a symbol of unity, or an approximate actual unit, for some sort of measure, over and above any we have yet dealt with.[1]

Reproduction of grand linear standard of Pyramid.

Following up this idea into the Grand Gallery, we find the vertical height of that to be, according to the diagram, 350 inches; or, seven times the height of the smaller passages. Now this is an all-important fact, if true; but is it true? In such a case, no blind trust can be placed in the diagram; and some discussion of original measures must be held; for the mutual contradictions of modern observers are almost past belief, and seem only explainable, on their not having attended particularly to what constitutes true *vertical* height, and what makes merely *transverse* height.

Height of Grand Gallery.

A tabular representation of the results of the chief authorities, gives the following series:—

[1] It may be remarked, that though the *inclined* passages be thus converted out of profane, into Jewish sacred, and Pyramid, measures,—yet the *horizontal* passage remains untouched. This is true; but while that Queen's-chamber passage is not a very important one, it has the feature, well brought out in Colonel Howard-Vyse's list of dimensions, of containing within its length two different vertical heights, or depths; one of them more than 50 inches, and the other less. The ante-chamber passage has likewise, within its short run, a similar sort of compensation.

GRAND GALLERY OF GREAT PYRAMID.

Authors.	Date of Observation.	Height.	Length.	Angle of Ascent.
	A.D.	Inches.	Inches.	
Greaves,	1639	312	1848	26°
De Monconys,	1647	..	1947	60°
M. Thevenot,	1655	..	1944	..
M. Maillet,	1692	300	1488	..
Egmont,	1709	270	1632	..
Shaw,	1721	270	1632	..
Perry,	1743	288	1800	..
M. Fourmont,	1755	..	1848	26°
De Binos,	1777	288	1632	..
Coutelle,	1800	320	1595	27°
Jomard,	1800	323*	1461*	26°
Caviglia,	1817	360	1824	27°
Richardson,	1817	312	1440	..
Wilkinson,	1831	..	..	27°
Howard-Vyse,	1839	336	1810 / 1872	26° 18′
Diagram,	1864	314 / 350	1790 / 1860	26° 18′

Travellers misled by the inclination.

In running the eye down these numbers, it will be seen at once that the hypothetical heights, which are both transverse and vertical, are contained within the variations of observers from each other; and if the vertical height be very near one limit, it arises most probably from the difficulty of observers, unprovided with suitable instruments, making full allowance for the unusual inclination of the floor they were standing upon.

We may, therefore, with full propriety, in the present state of our knowledge of the Great Pyramid, take the diagram-result as the true one; viz., that the Grand Gallery is *seven* times as high as one of the small, and

* Reduced from French feet to English inches.

similarly inclined, passages; and as each of these, in its vertical height, represents, approximately, the larger standard of the Pyramid,—the Grand Gallery, therefore, represents, rudely also, *seven* of these standards.

Why were gallery and passages made of their respective heights?

But for what purpose is the Grand Gallery holding up so notably to view seven of the said standards?

For the same purpose no doubt that the small passages are holding up one such measure; for they are constructions of the same family order; and if we could discover one, they would all be explained.

Grand Gallery owes its height to astronomical directions.

Now, touching the small passages, evidence is rather scanty; but with the Grand Gallery, it is far otherwise. How, for instance, have we obtained in the diagram the increase of 350, over 50, inches for its height? By considering its central theoretical line split up into two filaments, and these separated by the exact divergence of the angular directions of the upper and lower culminations of the Pole-star, in the vertical of the point D, where a notable intersection of the hypothetical lines occurs. (See Plate XV.) The height, therefore, of the gallery, is intimately connected with the observing astronomy of the place; and, from its position, extending southwards from the Polar fixing-lines, the Grand Gallery should represent the Equatorial, or *Time* measuring, parts of the sky.

Lower entrance to Grand Gallery, all-important in the hypothesis and arrangement of Pyramid.

This conclusion is further strengthened by almost every additional feature which exists. The point D, which is, for example, the similar theoretical entrance into the Gallery, that the real entrance is, to the Pyramid; and depends primarily on the *same Pole-star angle*,—is also, the most notable theoretical and practical centre in the whole Pyramid; for three passage lines, and three other theoretical lines all meet in that one point D; as exactly almost as we have been able to draw them; and without any previous notion of finding that they would all converge there, when we began to put them in, according to the principles already stated.

Equatorial line for the Pyramid enters there.

One of these converging lines, is no other than the *Equator* line of the Pyramid, drawn from the intersection of the base with the Polar line connected with the entrance passage. And the admission of this Equator line, into the Grand Gallery by that most marked entrance-point D, would seem assuredly to show, that the whole interior of the Grand Gallery is given up to the *Equatorial* subject of *time*.

Grand Gallery a region for symbols of Time.

The seven standards of length, therefore, in that place, become seven standards of time; and similarly, the one standard of length, in a small passage, is one standard, or rather, a unit, of time. Now, as to what constitutes a standard unit in chronology, there is no doubt or

difficulty whatever; for the rotation of the earth on its axis, is the one unit and standard which all men, civilized and savage, must use; and astronomy knows of no other phenomenon so likely to be perfectly, or all but perfectly, unchangeable. The universal unit of time.

Hence then, chronologically, the small passage of the Pyramid represents a unit day, and the Grand Gallery seven unit days; or, a week. In fact, that violent, and apparently unmeaning contrast of heights, has the noblest of reasons, viz., the typifying of the sacred division of time; and we see here, again, that in time, as well as space, the Great Pyramid embodies an idea which was entirely unknown to, or totally disobeyed by, the Egyptians; but was perfectly well known to the great Jewish Prophet and leader, though he had never been inside the Pyramid, and was regarded by him as a directly Divine command, which all good men ought to follow. Grand Gallery represents a *week* of seven days.

After arriving at such a result,—which is fully all that there is any occasion for, to enable us to consider subsequently, from the right point of view, the motives, intentions, and promptings of those who erected the Pyramid, and established there a metrology, of which Great Britain has been privileged to *inherit*, and still

Further symptoms of a chronological ruling in Grand Gallery.

preserves, one leading part,—there is hardly need to delay any longer over the case; and yet some classes of minds, and by no means ill-constituted ones, may desire to hear if there be further evidence of any kind or degree, bearing on the chronological intentions of the Grand Gallery,—before they admit the above conclusions in all their fulness.

Now there *is* more evidence of that nature; and therefore we can hardly terminate this chapter better, than by endeavouring shortly to describe a portion of it.

The great entrance-step.

At the very first entrance into the Grand Gallery, the visitor is met by a huge step, almost impossible to climb over; its height being, according to the French measure, 90·5 inches; a height which, increased for the ruling angle of the place, goes close to 366 times into the circumference of the Pyramid, eminently reminding therefore of the days contained in a year.

Overlappings of marble.

The east and west sides of the Grand Gallery, again, are signally marked by the *seven* overlappings of the large courses of polished stone, which Professor Greaves so much admired. What, then, do they mean, or stand there to typify?

Signify months.

A first conclusion is, looking to the Zodiacal character given to the great hall by its astronomical construction already described, that they have something to do with

months. In that case, however, there would be two *weeks of months,* or fourteen months in the year. A strange species of month certainly, and unknown to profane history; but how would it suit Nature?

Months of very even character.

By no means ill, we may answer; because, it would allow of all the 14 months being of the same length, viz., 26 days, with only the quantity of one day having to be added at the end of an ordinary year, and two days in a leap year; whereas the system of 12 even months of 30 days each, leaves either 5 or 6 days to be accounted for, according to the kind of year. Moreover, the number of 26 days, in connexion with one of those 14 months to the year (or at all events with these 14 overlappings of the great courses in the gallery), may be taken as indicated close underneath them, by those mysterious holes along the ramps or side-benches of "sleek and polished stone;" and which holes the far-seeing Oxford Professor of Astronomy declared, 225 years ago, must have been "intended, no question, for some other end than ornament." For along the western ramp there are precisely 26 holes, or the number of days in such a hebdomadal month; and though on the other ramp there are 28 holes, the position of the last two renders their presence there, and the use to be made of them, somewhat questionable. (See Plate XI.)

Twenty-six days to thirteen, out of fourteen, months.

To ascertain this point, the Pyramid inquirer should ascend the whole length of the gallery; and, at its upper end, climb over the high step that will place him on the level floor leading into the ante-chamber.

Of the two odd holes in the Gallery.

Arrived on that level floor, he will see a hole pressed up close into each forward corner, as if intimating, that in the room beyond will be found the explanation of those two extra holes. They are by no means to be confounded with those in the ramps, being of a different shape, and removed as far from them as the whole length of the step will allow: that step itself a notable time-fraction of the gallery's length.

Referred to the holes in the upper step.

These points will be best proved by the two following sections on Plate XVII., prepared from the French *Description;* and which have the further virtue of showing, that the holes in the ramps are not at right angles to the surface, but truly vertical; the same valuable direction that brought to light the linear Pyramid standard in every inclined passage.

Plate XVII.

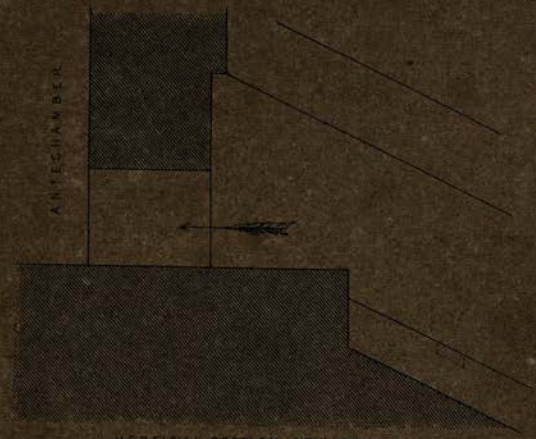
Time-symbols in the ante-chamber.

In the ante-chamber, then, we are to seek the explanation of the two "day-holes" remaining over and above the sets of 26 each, to a year of 14 even months; and what see we there? Why, what we saw before at Plate XIII. and p. 143, and found then to have a meaning on the density of the earth. But now, without

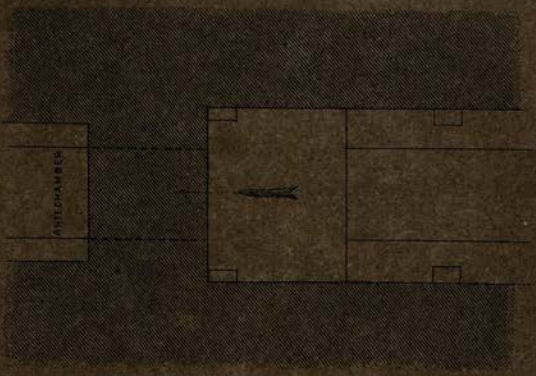
PLATE 17.

UPPER CORNER OF GRAND GALLERY LEADING TO ANTECHAMBER

SHEWING THE DIFFERENCE OF THE HOLES IN THE STEP AND THE RAMP.



VERTICAL SECTION OR ELEVATION



HORIZONTAL SECTION OR PLAN

SCALE OF INCHES

altering that result, a new interpretation can be put upon it; *i.e.*, the four grooves represent four years, three of them hollow and one full. The three hollow ones on the western side of the room have each "a cavity," (Greaves); those, therefore, are years, when only one day is to be added to the 14 × 26 for a year. But the fourth groove is filled from west to east, and therefore requires two days then to be added, making thereby one of our leap years of 366 days.

Leap-year typified.

Further refinement is hardly to be looked for, when these things of months and days are only necessary to make us quite sure, above all our other received indications, that there is some chronological intention about the grand gallery and its passage. And yet if more is needed it may be derived from this, that the full groove is not quite equal in breadth to one of the hollow ones; whence it may be taken as indicating, that the true length of the year is not, as most nations thought it in medieval and even later times, composed of 365 and ¼ days, but 365 and somewhat less than ¼, even as modern astronomy knows it really to be.

Refinements of chronological indications.

At the same time that peculiar force seems thus to be given to the principle of the week and the day, by the subdivision of the year into two *weeks* of months of 26 days each, supplemented by all the refinements

An ordinary and secular species of month.

required by exact chronology,—it is yet noteworthy to remark, that that special arrangement of months would seem to be overruled for practical purposes, by the subdivisions and overlappings of the *ceiling* of the Grand Gallery; which, if we may trust the French engraved plates, indicate another division of the year into twelve months, and these months again into groups or seasons of three months each.

More than enough ascertained, to indicate a chronological intention.

There is some confirmation of this French picture of the marbles which form the ceiling of the Grand Gallery, in Colonel Howard-Vyse's plate, opposite p. 158 of his second volume; but, unfortunately, there is not enough of it to depend on for the gallery's whole extent; and the further prosecution of this one idea, which, after all, occupies no principal place in our general argument,—may well be laid on one side, until further measures have been procured from the Pyramid itself; or at least during such time as we are discussing certain points of much more pressing and immediate character, which now claim our earnest attention.

CHAPTER III.

MOSES AND THE WISDOM OF THE EGYPTIANS.

Pyramid contains two of the sacred teachings of Moses.

AMONGST the more secure of the points discussed thus far, is that one respecting the stones of the Great Pyramid having yielded up, under question, their peculiar innate testimony to a measure of space, which proves to be the sacred cubit of the Jews, and a measure of time, which is the first Divine command in Genesis.

Did Moses learn them from the Egyptians?

But then, say many scholastic and erudite men,— "Genesis was written by Moses, and Moses was for many years of his life a priest among the Egyptians, who were a great and civilized nation when the progenitors of the Israelites were still merely wandering shepherds, always on the verge of starvation; and, according to the New Testament itself (Acts vii. 22), 'Moses was learned in all the wisdom of the Egyptians.' How much, therefore, of what he taught his own countrymen afterwards, may he not have learned from the servants of Pharaoh?"

Various modes of discussing the question.

On this question, a vast deal has been written in the world, from the literary side; but not very much from a mechanical, or material, or rather, matter-of-fact, point of view, although this is capable of throwing in some very vivid rays of positive information, which might have been not a little useful.

As propounded to literary men.

The literary men, for instance, have been sorely puzzled by the hierologists, who contend expressly for a civilized Egypt during 13,000 years and more; and produce points of community between the laws of Moses and those of Ancient Egypt, which they say he must have read, because they were actually *written*, as well as composed, long ages before his birth, in that highly polished and civilized society on the banks of the Nile.

Arguments from the literary side.

The refuge here of the literary men, seems to be, chiefly, that those tremendous dates have never been proved; and, as for the points of community, or rather, merely similar complexion between the Egyptian and the Mosaic laws, they exist only in certain subsidiary forms required for social order and political independence; and are such as a common human nature, with a like geographical position and chronological epoch, would have infallibly produced more or less amongst any set of people endowed with brains, and sense to amend their position in the world. And then there

comes to them the grander result, flowing from a philosophical investigation of the two systems as wholes; viz., that the real essence of the Mosaic law, is as totally distinct from the Egyptian, as any two things can possibly be. For, while the Egyptian system bases on a multitude of gods, half animal and half man,—and some of them not a little obscene, to an extent which makes us wonder at several modern European governments reproducing their portraits one after the other in costly folios, and large-sized plates,—who is there who cannot see, as the ruling principle in Moses, the most magnificent rebellion against all that power of sin in high places of the earth, and a grand assertion of the one, true, and only living God, the Creator of all things?

Grand distinction in their ultimate, and highest, ends,—between Moses and the Egyptian priests.

The zeal, too, of Moses, and his earnest self-sacrificing for the cause of God, and his anxiety to show Him at once accessible by prayer to every one,—are the liveliest contrasts that can well be imagined to the sordid routine of an Egyptian priesthood, placing itself immovably, for its own gain, between the people and their gods, such as they were.

Moses' zeal for the cause of God.

But the most decided and particular overthrow of the hierologists comes from the mechanical part of the question; for, to a great extent, what they have long been contending for, and have succeeded at last in

Argument from the mechanical, and material, side.

proving,—is precisely that which enables us to say most positively, that a cubit measuring-rod of the length of 25 Pyramid inches, and which has such extraordinary scientific value, and was made so much of by Moses,—was no part of the wisdom of the Egyptians.

Approved theory of the Egyptians' origin.

During all the time that the Egyptians were in power in the land of Egypt, it certainly was not; for we know there, by their buildings and by some of their measuring-rods, happily preserved, what the length of their cubit really was; and though the best ethnological theory of the Egyptians be that which makes them, not Ethiopians descending the Nile from the interior of Africa, but Asiatics and Caucasians entering by the Isthmus of Suez into Lower Egypt, and *ascending* the course of the river,—there seems no reason whatever to conclude that they had previously received or adopted that peculiar measure of 25 inches, which Sir Isaac Newton considers the *Israelites* possessed before their going down to Egypt.

Vitality and constancy of national measures.

Not only may it be said, that recent researches have proved the astonishing vitality of standards of measure through enormous intervals of time, and that an involuntary change of a people's standard from 20·7 to 25·0, or *vice versâ*, was never yet seen in the history of the world,—but it may be argued that the Egyptians, what-

ever faults they may have had, were a most conservative, methodical, and orderly people, with an immense genius for mechanics, and a marvellous appreciation of measure, so that they would be the last nation in the world to lose or mistake their hereditary standards.

The Egyptians adapted to preserve their standards.

The Egyptian cubit has, moreover, been known to other nations, and ostensibly employed, as it yet is, in their Nilometer observatories (which form still, as they have ever formed, the chief science of Egypt), for a greater number of years by far than the period,—lying between their origin and their earliest measured monument,—is reckoned at, by most of the modern chronologists. And throughout the whole extent of that more than historical period, the real Egyptian cubit has never been found, in any credible instance, more than a fraction of an inch different from the quantity above quoted, of 20·7 inches; nor have the hierologists ever uttered the smallest suspicion, that it has changed to that, from decidedly another quantity in earlier times.

Their standards known to the world at large for several thousand years.

We may therefore, with perfect safety, and hierologist support, regard the length of 20·7 inches as the veritable hereditary measure of the Egyptians; and the one which, if they had been copied from by any other nation or individual, would have been the length imitated and faithfully reproduced.

Their linear standard never otherwise, than 20·7 inches.

Moses' sacred cubit, certainly not copied from the Egyptian cubit.

Moses, therefore, in making the distinguished use which he did of a length of 25 inches, an integral fraction of the earth's axis of rotation, was decidedly not taking anything out of the known wisdom-book of the Egyptians, or anything which their amount and species of learning would have enabled them to arrive at.

The very structure of Moses' cubit, a thing hateful to the Egyptians.

Not only so, too, but in the number 25, he was adopting something which was particularly hateful to the Egyptians. Why it was, we do not know; but Sir Gardner Wilkinson speaks of 5 as being the "evil number" in modern Egypt,[1] and 5×5, or anything made up of 5, would seem to have been always repulsive to them.

Egyptian hatred of the number 5.

Particularly galling, therefore, to the Egyptians it must have been, to have seen the Israelites, when they escaped from bondage and went out of the country "with an high hand," itself a symbol of five,—especially galling to their spirits to see their late slaves go up, marshalled by "five in a rank," out of the land of Egypt, for so is the literal translation of the word expressed—"harnessed"—in Ex. xiii. 18 of the English Bible.

The whole of that affair must, no doubt, have been hateful, as well as disastrous, to the Egyptians; and they indulged themselves afterwards in some very con-

[1] Murray's *Handbook for Egypt*, p. 142.

temptuous phrases about it. They said, for instance, as we judge from the relics of Manetho,[1] handed down to us from various authors, that some persons, under a renegade priest of Heliopolis, named "Moyses," had been thrust out of Egypt by the king; and they were a very abominable set indeed, for not only were they all lepers and unclean, but their number is given as the very evil one of 250,000, or 5 × 50,000. Historical examples of the same Egyptian antipathy.

Their real number, we know by the Bible, was something very different from this, as well as their state; but it was a mode of blackening them to the Egyptians for Egyptian purposes; and similarly, when the "Hyksos" or "Shepherd Kings,"[2] also so much abominated by the Egyptians, established themselves in Avaris, in a remarkably inconvenient manner to Egyptian polity, they were described as men "of an ignoble race," and in number also "250,000."

But Moses had none of this most unwise hatred of 5, and times of 5; and though his first arrangement of years was the Sabbatical one of a "week of years,"—his next and by far the most important one, the grand standard in fact of time, was the jubilee, of 50 years; a number which, with the similar arrangement of days Moses' idea of 5, the reverse of the Egyptian.

[1] *Penny Cyclopædia*, p. 118.
[2] Gliddon's *Ancient Egypt*, p. 63.

Chronological Jewish standards founded on 5.

for the feast of Pentecost, brings up again the number of inches contained in the grand standard of length, belonging to the Great Pyramid.

The laws of Israel arranged on 5.

It is also worthy of note, that the whole of the sacred law was arranged on a system of five books; and five, too, expressly so called, in the "Pentateuch;" and this overshadowing of Israel, in this place, by the number five, seems even to have had some special intention in it; for when the best critics have pronounced so decidedly as they have done, and on completely other grounds, that the book of Job was written by Moses and by no one else,—yet cannot find the smallest reason for its anomalous position in the Bible, far away from all the other works of the same inspired writer,—we may almost venture to suggest, that one reason was, to prevent the unity and proportions of the five books of the "Pentateuch," as a system and symbol of 5, being interfered with.

Why was the book of Job, separated from the other writings of Moses?

Each of the books of the "Pentateuch" depends on the other; or, at least, Deuteronomy refers to Exodus, Leviticus, and Numbers, and they refer to Genesis; but not one of them refers to Job, and Job does not refer to any of them.

Yet surely the Bible itself would have been incomplete without the book of Job, and all its lessons of

supreme piety, humility, and wisdom. In the "Pentateuch," somewhat fettered to a particular purpose, the full genius of Moses and the whole of the wisdom he received from on high, had not their full range; but in the book of Job there came an opportunity, which was not lost, or slighted, of alluding more clearly to the immortality of the soul, and the necessity of a divine redemption.

Job, an essential appendix to the Pentateuch.

Again, to return to more moderate subjects, it was not till lately that we understood, or rather appreciated, the full tenor of some of the concluding passages of that remarkable book. In Job xxxviii. the Lord, "with whom is terrible majesty," proceeds to answer Job out of the whirlwind, confounding him in a moment with the grandeur of elemental phenomena, the form and size of the earth, the laws of solids and fluids, of light and darkness, of sea and air, of clouds, sunshine, rain, frost, and lightning; the series of wonders is appalling, their magnitude and duration verging on the infinite. But then, though softened by a gradation, of descriptions of the tender herb springing forth all the wide world over, there had seemed to our imperfect apprehension in former years, something like a descent from sublimity, in the account coming down to, and concluding with, a description of particular animals.

Characteristics of a certain Divine argument in Job.

Modern ideas on the subjects there treated of.

What the Egyptian wisdom, with its infantile knowledge of physical science and cosmical relations, would have said to that,—is hardly worth a serious inquiry; but this is what modern wisdom has involuntarily illustrated very lately, in the last published number of one of those large book-sized Reviews, which undertake to show existing intellectual society by means of the ablest writers, whatever the best minds have been producing on any branch of human research within the latest few months of time.

Their description by a teacher of the new science of thermo-dynamics.

The author, reviewed on the occasion alluded to, treated of the new science of thermo-dynamics; showing that heat is a form of motion; and, from that simple beginning, enumerating the laws of the earth's atmosphere, and the medium filling space; calculating the store of useful work still in the world; predicting the duration of sun, moon, and all material things; and then boasting, that now that this new principle in natural philosophy, —as represented in solar radiation, and so completely reduced by him and his friends to the subjection of calculation by man—is proved to be the one principle which supports everything we see,—that it may be said to " create the muscle, and build the brain of man; is heard in the roar of the lion, and the song of the birds; is seen in the gliding of the serpent," etc. etc.

Whereupon comes down on him the reviewer, with a higher philosophy and more religious truth, regretting that the author does not see, that no matter to what extent he can compute some few changes in the form of inorganic elements extending through space, he has not made the smallest approach to a single organic mystery; and has left untouched, any attempt even, at an explanation of how the tree is produced from the seed, or how fibre is joined to fibre in the animal structure; and infinitely more, wise Job's idea, "how wisdom is put into the inner parts," and the different created beings take up their appointed characters in life's varied drama.

Admirable correction of that teacher, by an anonymous reviewer.

In fact the best and latest of modern science, though for its own ends and purposes, has here represented the difficulties of nature for man to explain, to be culminating, precisely in the manner they were described to do, in the sacred Book of Job 4000 years ago; and we immediately confessed, on reading the modern philosopher, our former error; and involuntarily acquired a higher idea of the thoroughly-inspired character, in all his ramifications of subject, of the writer of that noble Book of Job, than we had ever possessed before.

Coincidence in *order*, between the best modern science, and the descriptions in Job.

Moses, then, in that inimitable work, instead of copying anything from the profane Egyptians of his day, was rather anticipating the march of science in the

Moses, not so much a copier of the Egyptians, as an anticipator of modern science.

Christian ages of the world; as he has done too, in some earlier parts of the Bible as well. And when we further find, that in other things, such as the standard division of time and space, and the enveloping nature of the number 5, he was going directly against the standards of the Egyptians, but coincidently with those of the Great Pyramid; of those parts, too, of the Great Pyramid which the Egyptians knew nothing about, and which he, Moses, *as a man*, could never have seen; or if he had seen, would not have been able, as a man, to read and understand, without the assistance of modern scientific knowledge to guide him,—when we meet with all these telling circumstances, and even parallel features between the inspired writings and the Pyramid, it certainly would appear, that we must be coming inevitably very close indeed to the origin, if not the purpose also, of that mighty fabric.

Parallel character between Moses' teachings, and the Pyramid's contents, though unseen by him.

Yet we crave the reader's attention for one moment more, to some necessary mechanical considerations, before venturing whatever we can on the final question, upon whose correct solution so much depends.

CHAPTER IV.

MECHANICAL DATA.

Useful mechanical considerations, and explanations.

FROM time to time, in the modern history of the Great Pyramid faults have been found, or improvements suggested, or difficulties started with regard to its construction; and, where such remarks have been the produce of able minds, it is well for instruction's sake in the present day, to turn back to their very words; as well as, if they have since been answered by further discoveries at the Pyramid, to note *how* they have been answered.

Dr. Harvey, on respiration in the Pyramid.

A case in point is offered by the conversation of Dr. Harvey, the learned discoverer of the circulation of the blood, with Professor Greaves, in or about 1640. The Doctor had revolved in his truly capacious mind, and from his own peculiar point of view, one of the descriptions given by the traveller, and had seen a difficulty which had not struck *him*.

Dr. Harvey's intuitive idea of oxygen, and ventilation.

To one so well versed in biological phenomena (though living long before the day of a knowledge of oxygen, or the chemistry of gases, or indeed any sort of chemistry), it seemed strange to Dr. Harvey "how several persons could have continued so many hours in the Pyramid and live. For," said he, "seeing we never breathe the same air twice, but still new air is required to a new inspiration (the *succus alibilis* of it being spent in every expiration), it could not be, but by long breathing we should have spent the aliment of that small stock of air within the Pyramid, and have been stifled, unless there were some secret tunnels conveying it to the top of the Pyramid, whereby it might pass out, and make way for fresh air to come in at the entrance below."

The chemistry of gases, not entered into by a mathematical genius.

Now that was a remark full of wisdom in every way, and if duly received and respected might have led to invaluable discoveries at an early period,—but Professor Greaves unfortunately could not see the vital importance of Dr. Harvey's *succus alibilis* mixed up in common air; neither had he considered very accurately the motion of aëriform fluids, when he fancied that both the old air might go out, and new air come in, by one and the same lower entrance passage; and, finally, he was certain, as one who had been at the Pyramid,

that "as for any *tubuli*, or little tunnels to let out the fuliginous air at the top of the Pyramid, *none could be discovered within or without.*"

Dr. Harvey on the principles and practice of ventilation.

To this Dr. Harvey replied most discreetly, "they might be so small, as that they could not be easily discovered, and yet might be sufficient to make way for the air, being a thin and subtile body."

But poor Professor Greaves on this occasion would not listen to reason, and only answered confutingly, he himself having chronicled his own words, that "the less they, the *tubuli*, were, the sooner they would be obstructed with those tempests of sand, to which these deserts are frequently exposed;" and with these and similar positivisms he obliged the Doctor, in a phrase of that day, and which may then have been classical and aristocratic English, "to shut up all."[1]

Discovery of what Dr Harvey had indicated, 200 years afterwards.

Yet what would Professor Greaves have thought, if he could have known, that 200 years after his remarkable conversation, Colonel Howard-Vyse would actually have discovered the existence of two such *tubuli*, leading to the upper parts of the Pyramid, and formed for no other purpose than that which Dr. Harvey had indicated, *i.e.*, to serve as ventilating air-channels; and that he, Professor Greaves, had himself actually seen

[1] Page 161, vol. i. of Greaves by Birch.

their lower extremities in the walls of the King's Chamber, and proved the fact by inditing the following almost photographic likeness of them :—

Professor Greaves' description of what must have been the lower ends of the ventilating tubes.

"The ingenious reader will excuse my curiosity,[1] if, before I conclude my description of this Pyramid, I pretermit not anything within, of how light a consequence soever. This made me take notice of two inlets or spaces in the south and north sides of this chamber, just opposite to one another; that on the north was in breadth 0·700 of the English foot, and in height 0·400, evenly cut, and running in a straight line six feet and further, into the thickness of the wall. That on the south is larger, and somewhat round, not so long as the former, and, by the blackness within, it seems to have been the receptacle for the burning of lamps."

Erroneous ideas of their nature and purposes in early times.

Upon which he indulges in a speculation upon the "eternal lamps, such as have been found in Tulliola's tomb in Italy;" and regrets to think how much better Pliny might have filled his pages, if he had described therein the composition of one of those lamps of "noble invention," rather than occupied them with lesser matters of natural description.

But the blackness adverted to at the Pyramid, would

[1] The exact meaning of this word has altered greatly in the last two hundred years.

PLATE 18.

THE CHAMBERS OF CONSTRUCTION.

PARTS OF CH. 4 PP. 251-255.

TO RELIEVE THE CEILING OF KING'S CHAMBER FROM SUPERINCUMBENT PRESSURE.

seem to have been caused simply by the fires which were occasionally made in the hole by Arabs with an inquisitive turn of mind, and merely for the chance expectation of seeing what would come of it. During the two following centuries also, the fashion seemed to grow up for each visitor and tourist to conclude his sight-seeing of the Pyramid, by firing his pistols into these holes. Innumerable persons, therefore, besides Professor Greaves, had the elements of the air-channel discovery in their hands: but, through not respecting sufficiently the *design* of the Pyramid and the intellect of the designer, they went away no wiser than they came, and the discovery of the best-ventilated room in all the world remained to another age.

Ill-treatment of the air-tube terminations by visitors and idlers.

Again, certain early authors, of a critically mechanical turn, looked up at the ceiling of the King's Chamber, roofed with *flat* beams of granite blocks, and expressed their thoughts, almost in the manner of a judgment, "that those beams had a vast weight to bear" (all the weight of the upper two-thirds of the Pyramid above them), and with some allusion to the "arch," rather hinted "that *they* could have made a better disposition of the material."

Criticisms occasionally indulged in, touching the mechanics of the King's Chamber roof.

It has been supposed that the boastful legend inscribed by King Asychis on his pyramid of brick at

Brick, compared with stone, buildings, for lasting powers.

Dashoor, one thousand years after the building of the Great Pyramid, referred to the invention or earliest construction of arches in brick. "Compare not me with the pyramids built of stone, which I as far excel as Jupiter doth the other gods. For striking the bottom of the lake with long poles, and gathering the mud which stuck to them, man made thence bricks, and formed me in this manner."

Rock masses similarly compared with built masses.

Contemporary science applauded that invention, and thought it perfect; but 4000 years have reduced nearly all the brick pyramids to rubbish, giving us reason for thanks that *that* scientific improvement was not adopted in the Great Pyramid. By itself, no doubt, the arch was good, and a brick arch stronger than a brick beam; but neither a brick arch, nor an arch of little stones, has stood so long as a beam of solid granite in circumstances similar to those of the King's Chamber.

Admirable testing of roof of King's Chamber.

If the roof of that chamber *had* at any time fallen in, and crushed the coffer below, which it was meant to preserve,—then all the scientific critics might have started up with reason, to propose a more durable mode of roofing; but in presence of that roof's perfect performance of its duty, for a longer period than any other human building has lasted, it was strange, to say the

least of it, that such a readiness to give advice should have been manifested; for, as M. Jomard most admirably expresses it, "under this view of the perfect state and condition of the whole room, the architects have eminently attained the end which they proposed to themselves more than 3000 years ago."

Pyramid architect acknowledged to have succeeded.

"Ah! but if they have only saved themselves by the skin of their teeth," urges a critic unabashed; "if they have been indebted to a happy chance for the result, of which the precise contrary might at any moment have befallen them!" Well, that is an objection that might have been lamented in Professor Greaves' day, when men knew nothing of what the means for strength employed by the architects were; or even, whether they had had their attention called to the importance of the point. But ever since the discovery of "Davison's chamber," the first hollow over the ceiling of the King's Chamber, in 1763,—the learned must have seen, that the requirements of the case had been skilfully entered into by the builders; though no person perhaps had any idea, until Colonel Howard-Vyse made his celebrated explorations in 1839, of the extraordinary completeness with which the scientific mechanical object had been carried out; a completeness so striking, that we have never heard since then, of any more complaints

Of the means whereby the Pyramid Architect procured his success.

or fears for the safety of the ceiling, having been expressed by any competent person.[1]

Plate XVIII. shows the Architect's means and precautions.

Plate XVIII. gives an idea of the arrangement adopted. Besides the large, and pyramidally typical, number of five hollow chambers, one over the other, and the topmost one roofed with opposed sloping blocks,—it will be observed, that the upper surface of every set of horizontal blocks is left rough and unfinished.

Distinct error in the French Engraving.

This is a feature, the truth of which, and perhaps the importance also, entirely escaped the French *savants* of 1800; whence it came, that they represented the upper-floor surface of Davison's Chamber as absolutely level, and also parallel to the ceiling below, in the beautiful and microscopically finished engravings of their great work! The same error is to be seen also in Hekekyan Bey's "Masonic" book on the *Siriadic Monuments;* and it is there unfortunately carried through the whole of the Chambers of Construction.

[1] Plate XVIII. is taken very nearly from Colonel Howard-Vyse's plate in his second volume. He is, of course, the one great authority for the chambers of construction, four-fifths of which were entirely discovered by himself; and all of them most honestly and conscientiously measured in every direction. His plate, nevertheless, has some slips in it; the scale, for instance, is entirely erroneous; and there are markings under the fifth longitudinal "flagging over" of the stones of the Grand Gallery, as well as over each of the holes in the ramp below, for which we have not been able to find any written explanation or confirmation. In place, therefore, of representing the view to the east, we have given that to the west, where there are several authorities to choose from for the small details.

Yet, had the Pyramid architect so prepared and cut away the upper original surface of each set of horizontal granite beams, he would have notably weakened their strength, and not have done good to any one; for as these chambers of construction were not intended to be entered, it signified not in the least whether their floors were even, or uneven to any degree.

The roughness of these floors proves the constructive and economical genius of the Pyramid Architect.

The whole arrangement was indeed a similar exhibition of mechanical genius, looking for efficiency rather than show, to that one described by Professor Rigaud in an early transit-instrument of the Oxford Observatory; where the artist-optician had left, for strength's sake, the rough, original skin on the outside surface of the sheet brass, though he had planed or filed the under surface true and square enough, wherever a joint had to be made, or a bearing secured; even as the Pyramid artist had likewise dressed and squared the *under* surface of all his granite beams.

A similar instance in modern instrument making.

Then again, no one seems hitherto to have had any respect, and that because no understanding, of why the mass of solid masonry was so overwhelmingly large, compared with the hollow portion of the Pyramid; the latter being only about $\frac{1}{1600}$th of the former.

Why such a superabundance of solid masonry in the Pyramid.

Firmness and duration they thought would have been given by a far less amount of solid substance; wherefore

Ill-judged and destructive exploring curiosity of visitors.

and for that mere fancy of their own, feeling sure that there must be many chambers still undiscovered, they immediately began ruthlessly boring and cruelly blasting into the exquisitely arranged marble blocks, and to a depth often of a great many feet, merely to see what blind chance might possibly lead them to. Forgetful, too, of a really very wise piece of advice, said by an Arab tradition to have been engraved on the ancient casing-stone surface of the Pyramid: "I have built them, and whoever considers himself powerful, may try to destroy them; let him, however, reflect, that to destroy is easier than to build."

Principles for the guidance of explorers.

Had Mehemet Ali or Ibrahim Pasha been inclined to intellectual tyranny, what sport to them to have had up before their judgment-seat, each of those quarrying Paul Prys; and made them render forth, if they could, anything like a reason for the opinion that was within them, as to why they *should* have met with success by making a hole in the particular direction they did; and if they could not give such a reason clearly and convincingly, order them to put back every stone they had pulled out, precisely as it was before; a more than sufficient occupation for the remaining term of their natural lives.[1]

[1] Connected with this view, or as imparting some idea of what the nature of the punishment would be, the following account is given by the Arabian author, Abd Allatif, who wrote more than 500 years since, and who, in

Who too, among Egyptologists, would escape such a judgment! Not even the excellent Sir Gardner Wilkinson; who, when describing the Queen's Chamber in the Great Pyramid, says with the most inimitable coolness, and without a pang on his conscience for the mischief he had done to so precious a work,—"I *excavated* in vain below, in quest of a sepulchral pit."[1]

A lamentable instance, freely confessed.

Yet infinitely more blameable, were those before him, who made similar, and more destructive excavations with the idea of finding a passage leading to the Sphinx!

Worse instances remain.

the times of boasting and romance, described even his own exploits in such modest truth as this:—"When I again visited the Pyramids, I entered this passage with several people, but having penetrated about two-thirds into the interior, and having through fear completely lost my senses, I returned half dead."

A bad explorer, then, but an excellent historian, Abd Allatif relates in the latter capacity:—

"When Malic-alaziz Othman Ben Youssuf succeeded his father, he was prevailed upon by some persons of his court,—people totally devoid of sense and judgment,—to attempt the demolition of the Pyramids. He accordingly sent miners and quarrymen, under the superintendence of some of the officers and emirs of his court, with orders to destroy the *red* pyramid, which is the least of the three. They encamped near it, collected labourers from all parts of the country at a vast expense, and endeavoured with great assiduity for eight months to execute the commission with which they were intrusted, removing each day, with great difficulty, *one* or *two* stones. At length, having exhausted all their pecuniary resources, their resolution grew proportionably weaker as their labour and difficulties increased, and they were at last obliged to give up the undertaking as hopeless. While they were still engaged in the work, observing one day the extreme labour it required to remove one of the blocks, I asked an overseer, who was superintending the operation, whether, if a thousand pieces of gold were offered to him, he would undertake to replace the block in its original position; he answered, that if he were to be given many times that sum he could not do so."—COL. HOWARD-VYSE.

Difficulty of destroying, and far greater difficulty in rebuilding, even the smallest of the Pyramids.

[1] Murray's *Handbook for Egypt*, p. 167.

Unfounded idea of a connexion, historical or architectural, between Sphinx and Pyramid.

The great Sphinx! a structure not far removed in distance, it may be, from the Pyramid, but, of an entirely subsequent age; and realizing to the very utmost, the idea and essence of Pagan idolatry; that accursed thing of which the Great Pyramid is so essentially free. Even the very "sarcophagus," as Sir Gardner will call the coffer, in utter control to a theory not yet proved applicable there, "is," says he, "entirely destitute of hieroglyphics; which is the more *singular*, as it is the very place of all others where we might expect to find them."

Isolation of Pyramid both from Sphinx and all the surrounding tombs.

How much is it to be regretted that so able an author, of whom all Egyptian writers speak highly, should never have thought of tracing up that singularity which he himself had remarked; and developing it into that astonishing "isolation," not only from other Pyramids, but from everything of Egyptian intention, such as now appears to be, and to have been from the beginning, the attribute of the Great Pyramid.

The solid masonry of Pyramid.

To return however to the enormous *mass* of unoccupied masonry, which was nearly useless, when the object was regarded only as a tomb, and obstructive, as a temple, —how exceedingly necessary it becomes when looked on as a means of preserving an equal temperature for unexceptionable scientific observation. In the standard-scale experiment carried on in 1851 and 1852 by the

late Rev. R. Sheepshanks, on the part of Government, and described by the Astronomer-Royal in the *Philosophical Transactions* for 1857, it is stated that an alteration in temperature to the extent of ·01 or ·02 of a degree Fahr., was enough to produce a sensible change in the length of the standard bars. And also, that the temperature of the observing-room, two stories underground at Somerset House, was, on some occasions, nearly twenty degrees lower than the standard temperature of 62°!

Its use in equalizing temperature.

Hence unnumbered troubles arose to the British Government from the difficulty, or almost impossibility, of obtaining either sufficiently accurate thermometers or thermometer observations, or determinations of the different expansions of bars at various temperatures; or, finally, perfect freedom from the chance of some future *savant*, who shall make heat his study, finding out a theoretical correction, the neglect of which in large changes of temperature may have vitiated all that has recently been done for mere bars; just as, a few years ago, Bessel's *vacuum* correction for a pendulum, overthrew in an instant the accuracy of all the British Government's previous determinations of the length of a seconds-pendulum, and its proportion to the national measure of length.[1]

Troubles to British Government from not having a similar Observing-Room.

[1] Since the passing of the said Act, it has been ascertained that several elements of reduction of the pendulum experiments therein referred to are doubtful or erroneous; thus it was shown by Dr. Young, *Philosophical*

Degree of equalization of Pyramid internal temperature.

From our Edinburgh observations, however, of rock temperature, it may be concluded that at 100 feet in depth, inside the Pyramid, the variation of heat would never exceed ·01 of a degree of Fahrenheit. Now, the King's Chamber is at a greater depth, or 180 feet; but that additional depth is plainly required to compensate for the altering effect of the currents of air through the air-channels.

Effects of the ventilation on the temperature.

This ventilation must tend somewhat to disturb the equality of heat which reigns naturally in the heart of the Pyramid, and the question comes to be, how much? To this, in the absence of direct experiments, we can only at present return answer, that the effect would probably not be very sensible; for the tubes being no more than a fraction of a foot in bore, the small quantity of air they pass, must inevitably soon acquire the temperature of the long sides of the channel. This, in degree, is a generally acknowledged effect in engineering, and one too which is troubling the working of the

Transactions, 1819, that the reduction to the level of the sea was doubtful; by Bessel, *Astron. Nachr.* No. 128, and by Sabine, *Phil. Trans.* 1829, that the specific gravity of the pendulum was erroneously estimated, and that the faults of the agate planes introduced some degree of doubt; by Kater, *Phil. Trans.* 1830, and by Baily, R.A.S., *Memoirs*, vol. ix., that very sensible errors were introduced in the operation of comparing the length of the pendulum with Shuckburgh's scale, used as a representative of the legal standard."—*Report of Treasury Commission on Standards*, December 1841.

deeper coal-mines near Sunderland extremely; for, ventilate them with cold air as abundantly as engineers may, and by all manner of mechanical expedients, they cannot keep down the high earth-temperature, due to the very great depth of those mines, from asserting itself; and to such an amount, that it is expected there will soon be found a limit beyond which, from this cause alone, it will be impossible to work the deeper beds of coal.

Power of a large solid mass to control the temperature of a ventilating current.

It is probable, indeed, that a greater source of disturbance of the inside temperature of the Pyramid than the air outside, would be found in the breathing and lights of the visitors; or rather we will call them now, with a view to legitimate ends, the observers. Even there, however, the circumstances have been admirably met; for, 1*st*, the narrow and steeply-inclined entrance passages preclude many persons ever venturing in at a time; 2*d*, the Grand Gallery forms a large ante-chamber, where the chief number of persons not actually required in the very observation, may remain innocuously; and 3*d*, the one or two observers who must go forward into the King's Chamber should, if possible, not leave its nearer end; and then, as it will be seen by reference to our Plate XI., the two air-channels will be in the best position for carrying off, and preventing, all

Internal sources of disturbance to Pyramid temperature.

Their correction.

hot emanations from injuring the porphyry coffer, at the further and unventilated end of the quiet room.

Full meaning of the Air-Channels.

Those air-channels were evidently never formed for the direct benefit of the coffer itself, according to any hypothesis yet promulgated about its requirements in that way; but rather to prevent indirect ill effects to it through the observers who should enter from time to time; but who need not, with properly devised observing-apparatus, advance further up the room than those few first feet of its length, where the action of the ventilating channels is direct and immediate.

End of the Pyramid, as viewed from modern metrological science.

Modern metrological science, as viewed from the Pyramid.

Having thus seen how well the Great Pyramid comes out, when viewed by the light of modern science; let us now see how modern science in metrology fares, when tested by fact, and the forty centuries' experience of the Great Pyramid.

At each epoch of national attention to weights and measures, either in Britain or perhaps any other modern country, science has been particularly well pleased with what it last accomplished; in so far, as that the men employed on each occasion, gave far more attention to minute sources of error than their predecessors had done, and effected important improvements on the state of matters as they found it,—this was well; but when

their advances were so prodigious as to annihilate the value of nearly all that their predecessors had done; and when that effect has been seen in operation three times over during the present unfinished century, some modest views may well be allowed expression, as to the possibly not final condition of every single element in the weights and measures' question even yet.

Frequent *bouleversements* in modern Metrology.

Probably not completed yet.

To take merely one of the simplest amongst the many points which present themselves, viz., the *material* of a standard scale, is there no room for improvement there?

Francis Baily appeared to think that there was none, when he presented to the Royal Astronomical Society in 1834, amid the hearty plaudits of that learned body, the scale which he had just then prepared for them. The older scales by Troughton, Kater, and the French Academy, were stigmatized by him without mercy, and a tube of drawn brass, tube within tube, considered the height of perfection.

Of the material for modern Standards.

And yet the short space of fifteen years had not been accomplished, before the material of that scale was condemned as having *altered its size*, and by that destroyed its metric character for ever and ever; the arrangement of the new-comparing apparatus, prepared with it, was also exploded as "spider-legged" and bad; while the mode in which the temperature-correction had been

Change of opinion within the last few years.

obtained, was deemed radically wrong, and never to be repeated on any future occasion on any standard scale whatever.

F. Baily's latest improvements.

What then was the next move? Why, a very good move so far as it went; and Francis Baily, a man with splendid parts, himself lived to commence it. From wrought metal, which is always seeking to recover itself from the strains of the hammering or rolling, to which it has been exposed in the manner of its production, he went to cast-metal; and from a soft flexible metal like "brass," he went to a hard and brittle one, viz., gun-metal, and got something much better than his former material, though still far from perfection, before he died.

Rev. R. Sheepshanks' services.

On his death, the subject was taken up on the part of Government by the Rev. R. Sheepshanks; but he was inclined to prefer pure metals rather than alloys, and had a great idea of cast-copper, notwithstanding its softness, and the trouble of its production in a sound state.

Rev. R. Sheepshanks' character.

But when he also unfortunately demised, "then died, almost in the scene of his labours, and with his thoughts still intent on them, a man whose equal in talent and perseverance, in disinterestedness, in love of justice and truth, I have scarcely known," writes in admiring testimony Mr. Airy, Astronomer-Royal, his friend who knew

him well; and the question of soft pure metal went down to zero, and hard alloys became again the standing order of the day. This conclusion, too, had been helped on by the celebrated Mr Faraday having been applied to, and having written thus under date about 1847:—"I do not see any reason why a pure metal should be particularly free from internal change of its particles, and on the whole should rather incline to the hard alloy than to soft copper, and yet I hardly know why. I suppose the labour would be too great to lay down the standard on different metals and substances; and yet the comparison of them might be very important hereafter, for twenty years seem to *do* or *tell* a great deal in relation to standard measures."

Clashing of opinion on material for Standard scales.

Faraday's advice.

Modern science therefore could not guarantee, even so late as seventeen years ago, any material for a standard scale to last, that is, to keep its length, surface, and physical character internally, even through twenty years; and yet these scales are required to remain exact through all time; and the whole of the surveys of the country, and the commerce, as well as the natural philosophy, of the nation, depend implicitly upon them!

Modern science at fault thereon.

So this was done, and this was all that was done, in a case that must have struck the learned patriots concerned, with a mortal chill, on knowing the evil they

Government proceedings in the emergency.

The last standard-measures constructed.

might bring upon British metrology in its widest sense,—the Committee sanctioned the employment of gun-metal, cast copper, cast-iron, forged iron, and cast-steel; and in Mr. Airy's clear and instructive paper of 1857, in the *Philosophical Transactions*, he gives the particulars of somewhere about 47 bars of gun-metal, 9 of brass, 2 of copper, 9 of forged iron, 4 of cast-iron, and 6 of cast-steel, being converted into standard measures of British length-measure; and these constitute the sum of what the nation has to trust to through future time, the older reference to *natural* standards having been officially and definitively thrown overboard at last, as the following extracts prove:—

Recent official abandonment of *natural* standards.

"On the question of referring the value of the measure and weight represented by the standards to natural elements.

"40. After due consideration of this question, referring to the reasons explained in chapter ii. of the Report of 1841;—December 21, we adhere to the recommendation contained in that chapter, and embodied in articles 1 and 2 of the same Report, that no reference be made to natural elements for the values represented by the standards."—See Report of Treasury Commission on Standards, March 28, 1854.

Is the nation likely, then, we may ask, with its usual

good luck, to be fortunate in this instance? Will these standard-bars retain their length, strength, and consistence unimpaired for many ages? Will these mere human manufactures, in perishable and flexible substances, in matter capable of passing from a fibrous to a crystallized state by the mere effect of vibration, and of combining with portions of the atmosphere more readily than any other general solid,—will such artificial things in this case forego their usual habitudes, and, doing what they are now desired to do, remain, as it were, of a *natural* and perpetually unalterable length?

Implicit and blind trust in human manufactures.

A friend near us doubts whether some of them will be of the same length in a few years' time! He had been advised to take a steel measuring-rod out to Greece as a means of determining very accurately the size and proportions of the Parthenon; and in a few months he found that it, the steel rod, had shortened materially to the finger, and visibly to the eye. He complained to the instrument maker, and was told that that was *always* the case with steel rods, for they went on slowly for years recovering themselves from the effects of all the drawing and hammering, by which they had been extended out at the forge, whether cold or hot. And a practical man of truly philosophical mind might just as well throw overboard all reference to a *natural* mea-

Physical changes producing an alteration in the length of a steel measuring-rod.

Effects of hot, and cold, hammering.

sure of time, when once he has got possession of a well made watch,—as those eminent men, who have charge of our national metrology, are justified in hanging all the future credit and interests of the nation in that direction, on an artificial manufacture to form a measure of space, unchecked by reference to natural standards.

Government's theory.

The Government report, so far as we understand it, seems to shield itself under the belief, that the alterations alluded to only occur in metals that have been extended in the cold state; wherefore their Commission has boldly used hot-forged malleable iron; and the so-called *cast steel*, which usually undergoes a deal of hammering, before the rudely-cast ingot has assumed the qualities which fit it for the ordinary applications of steel. Yet the position is hazardous to a degree, for Baily's "drawn" tubular scale altered in the course of a dozen years, although it had been re-heated over a charcoal fire as a finishing to its various preparations; and there is no absolute line of demarcation, for scientific purposes, between the cold, and hot, hammering of metals; for abundant hammering of cold metal, may make it very hot; and a moderate amount of hammering may be kept up on a bar, that was taken out of the furnace actually white hot, until long after it has ceased to glow visibly.

Changes of length in a brass measuring-rod.

All varieties of manufacture of wrought-metals, suspicious.

If, however, some special process may have been invented, to enable cast-steel to be used without any hammering,—then it comes under the same category of objection with cast-iron, and cast gun-metal, viz., that they were melted only the other day; and their secular as distinguished from their periodical or immediate contraction, on cooling from the red-hot state, is not yet accomplished; and though little or no attention has been hitherto paid to this residual effect of heat, it is daily becoming more acknowledged in accurate science, and affects the glass of thermometers and fluid mercury as well as the rigid metals. In short, there is an action of *time* on all human prepared things, which is ceaseless, potent, and inevitable; nor has man been able fully to imitate, prevent, or even predict its nature, or define the extent of its influence.

Suspicions attached to cast-metals.

Secular, as well as periodical, expansion effects of heat.

Even during the course of the last standard-scale experiments it was found, that bars but recently cast (that is, within three or four or more years) have not always taken up a sensibly constant length either for a year or a month, whence we find such extracts as these in the Report:—

"But, in the opinion of Mr. Sheepshanks, though the whole discordance scarcely exceeded the effect of the thermometric expansion of *bronze* 28[1] for 0·3° Fahren-

Rev. R. Sheepshanks' experience of cast-metal.

[1] The name of the bar.

heit, it was impossible so to explain away the whole or a large part of it, and he was fully convinced that bronze 28 had sensibly shortened."[1]

The Astronomer Royal's experience

And again: "The conclusion, I think, is irresistible that bronze 28 really was shortened at the beginning of April, that it recovered its exact length before April 30, but that this recovery took place with some fluctuations, so that on May 1, it was subject to nearly the same error as before. Bronze 21, observed on June 26, exhibits a similar discordance. What circumstances can have produced these changes, or how far the later fluctuations are more apparent than real, I am wholly unable to conjecture."[2]

Oxidizable nature of metals.

The gun-metal employed has the further disadvantage of having introduced into its substance the metal zinc (for it is of the following composition: copper 16, tin 2·5, zinc 1), which is the very essence of oxidation, galvanic action, and a general breaking up into small fragments; while the steel and the iron are awfully prone to rust.

Rusting of steel and iron standards.

To such an extent does this rusting tendency prevail, that in *one night* an "end bar" was found to have grown longer by ·001 of an inch, as it lay on the comparing apparatus in the observing-room at Somerset

[1] *Phil. Trans.* 1857, p. 682. [2] *Ibid.* p. 683.

House. This was indeed attributed to some special galvanic irritation, caused by the steel end of one bar touching the agate end of another; but if such a generally innocent material as agate brought on that effect, and to so visible a quantity in one night, what may not occur in the night of 5000 years?

One night's deteriorating effect.

It is indeed strange, that with the soul-oppressing sublimity of all future time before them, the British Government did not profit more by the wisdom, as well as the experience, of the many ages which preceded the lives of her great men, still in existence. These men had certainly found, and tested over and over again, that manufacturers could make no metal so hard and free from oxidizing influences, as is agate or sapphire; and therefore they at last formed the terminations of their "end bars" of that species of material; but all the length of the bar, which held these fiducial jewels at either end, was still left in the suspicious substance of iron, steel, or zinco-gun-metal, in all of which substances modern science declared, no later since than 1847, that twenty years might produce extraordinary and unexpected changes; indeed, with moisture to assist, such a length of time in special exposures would make very short work with some of them. Even in the best exposures, the gradual incorporation of the oxygen of

Importance of extraordinary precautions, where great intervals of time are concerned.

Modern Science confesses itself unable to predict the metrological sufficiency of a bar of manufactured metal, for twenty years.

Alterations experienced by the standard weight-measures of the country.

the atmosphere with the *brass* of all the older weights belonging to Government, has altered them to such a degree, as to cause them to be rejected as standards; and with the platinum weights now employed,[1] their softness may lead to abrasion, while no one knows how long they will continue as compact lumps of metal, or when they may break up once more into their primitive granulations.[2]

What better course remains to be tried?

Yet if modern science be, as indeed would seem from much of the above, altogether unable to guide to anything safer,—many may be inclined to argue, that Government could not have done anything better than precisely what they did.

To this, however, we must demur, so long as the

[1] These are for the primary standards; the secondary standard weights, are of brass, gilt by the electrotype.

Result of ten years on the new Parliamentary pound-weight.

[2] At the date of sending this MS. to press, June 22, the news arrives from London, that an unexpected and deteriorating effect, temporarily but not permanently, has already befallen the Parliamentary standard of the Pound-weight, prepared only ten years ago; for it was recently discovered to have "become coated with an extraneous substance produced by the decomposition of the lining of the case in which it was preserved." The result is described to have been, that the said pound-weight, having been cleaned by solvents, or friction, or otherwise, and being reweighed by the same parties who prepared it, was found to be "entirely uninjured;" and the whole occurrence is viewed, rather as furnishing subject of congratulation, on the superiority of the present Standard Act for restoration of the Standard in case of loss or injury, over the last preceding Standard Act, which required reference to a weight of water. But no particulars are given of the cleaning, abrading, or dissolving operations to which the weight was exposed; or the chemical nature and habitude of the matter, thus forcibly removed from its surface.

Great Pyramid exists on its natural platform, holding true to its faithful "encastrements," and showing a magnificent length of nearly 10,000 of its units for a linear standard, showing them, too, unchanged from age to age, in a grand mass of firm, solid, and geologically uninjured, rock; and so long as the Porphyry Coffer remains in the well-ventilated King's Chamber of the same Pyramid, exhibiting to us a smaller standard measure of 4000 years ago, with the tenacity and hardness of its substance unimpaired, and the polish and evenness of its surface untouched by nature through all that length of time.

The successful example of the Great Pyramid, both in linear and capacity measures.

Man has been hitherto the only injurer of the porphyry coffer; and even he has sometimes found himself unable, though an educated and powerful European man with hammer in hand, and stupid ideas of ambition in his head, to make any impression upon this exquisitely-wrought heritage for all the world, prepared, in primeval times, with loving care towards these latter days in which we live. Indeed, that particular species of porphyry of which the coffer is composed, realizes all that modern metrologists have been seeking for in principle, during ages past, and realizes their desiderata even to a higher degree than they had ever expected, or hoped, to find. The coffer porphyry

The Coffer standard uninjured by nature, during 4000 years.

Metrological excellencies of the material of the Coffer.

does this, because, 1*st*, being an igneous rock, it may be looked on as a *cast*, rather than a *forged*, metal; 2*d*, it is hard and inflexible to a degree beyond the hardest and most inflexible even of Baily's gun-metal; 3*d*, it is more anti-oxidizable than any known metal; 4*th*, it is less affected in length by variations of temperature; and 5*th*, it was cast, not like Baily's, or any other man's, gun-metal only a dozen years ago, *i.e.*, late in the nineteenth century of the Christian era,—but thousands, and even hundreds of thousands of years before the days of Noah, if there be any truth whatever in the whole science of modern geology. The "secular contraction," therefore, of that material, has been abundantly overcome, so as to allay all suspicion of further change from that cause, during any extent of time that the people of Great Britain, or even their remembrance, is likely to last.

Transcendent excellence in the question of time.

Why was not the example of the Coffer, imitated in British measure-making?

Why, then, did not the British Government, with the responsible task before them, of representing this nation's weights and measures to all the peoples to come, in the dim and mighty future of the world,—why did they not profit by the example of an actual primeval standard measure before their eyes; and a measure which, in its present shape, has lasted a hundred times as long as any of their own standards; and, in the attribute of an

unchanged, and almost unchangeable, material, has lasted ten thousand times as long?

Antiquity, said to have been despised.

A critic, who assures us that he has more knowledge of the social world, in his little finger, than we in our whole body, rather too readily replies, "because a man of *London society* in the present day, will admit no one but another man of London society to any equal exchange of ideas; and thinks himself entitled to put his foot on the neck of all other existing peoples and all antiquity; so totally unworthy are they all to compare with him and his order, the best and greatest and wisest and richest, that has ever appeared on the earth; having nothing to learn, and nothing to admit, from any quarter whatever, but themselves."

The metrological bearings, and high purposes of the Pyramid, not hitherto perceived.

We would, however, with all earnestness, and we hope no little of truth, suggest, that the reason is rather because the English nation, though long since acknowledging the mighty antiquity of the Great Pyramid, have never thought seriously of looking on that building as at all connected with standard measures; or as being anything more in design, as well as execution, than the handicraft of men. For had it ever dawned upon their remotest thoughts, that there was really more than the human mind in that structure; that its erection had been directed by the *fiat* of Infinite

A right understanding of the case, would have produced a right action in the British nation.

Wisdom; and that it contained the lasting records of one of those early revelations of the Deity to primitive men, ages before the time of Moses, and even before Abraham also, yet not unalluded to in the *subsequently-written* Holy Scripture,—the strong religious feeling of our land would have compelled a national attention to the subject.

The "Inspiration" theory of the Pyramid, requires the most careful and respectful handling.

Such ideas are not to be lightly introduced; nor are they, again, to be contemptuously silenced merely because they are new, and unexpected by human learning; for time, in its progress, reveals something of what man can never fathom, viz., the intentions and previsions of the all-wise Creator himself: so that, if we grievously mistake not, there are vastly more powerful opinions than any touched on yet to bring forward in the present cause; and it is something of these, which we shall now shortly endeavour to set forth in a few concluding pages, on the last and grandest light in which the Great Pyramid question can possibly be viewed by men advanced in Christianity and experienced in faith.

PART V.

INEVITABLE CONCLUSIONS.

CHAPTER I.—HIEROLOGISTS AND CHRONOLOGISTS.

The "long chronology" of Egypt.

No land has been so variously treated in chronology as the valley of Egypt; for even if the early mysticisms of an existence of kings during 36,500 years be exploded, there are still some very extraordinary theories in high places. By some of the philosophical writers of history, for instance, in latter times, the early dynasties of Egyptian kings have been pushed forward from possible Scripture dates up to 10,000 and 13,000 years ago; and with the accompanying statement, that even at that remote epoch there were no signs of any gradual emergence out of a primitive savage condition, but only of an already highly organized and well-governed community, which might have commenced to run its course an infinite length of time previously.

More recently still, not only have geologists claimed

Scientific arguments in favour of long chronology.

to have discovered proofs (in fragments of pottery dug up at a great depth in the alluvial deposit of the Nile) of an existence of human manufactures there during more than 10,000 consecutive years; but there are many very worthy men who still attach much importance, to the computations made, astronomically, from certain configurations of the ecliptic and equator in the celebrated zodiacs of the Nilotic temples of Dendera, Esneh, and E' Dayr.

The first class of authors mentioned, in a great measure, either stand or fall with the two latter, and the proofs, more or less material, which they offer in confirmation of their theories.

The geological argument, shown to be unsound in its physical character.

Now, of the geological evidence, it has lately been argued by the acute Mr. Balfour Stewart, of the Kew Observatory, that a solid mass of any substance of notable size, has an effective tendency to work its way downwards through a bed of finely-divided particles of similar matter; wherefore, it is no positive proof, ages after a big bone, or piece of pottery, or anything else of comparatively large dimensions, was deposited on a certain soil, that it should be of the same date as the smaller particles of the stratum it is subsequently found in; for it may have worked its way downwards while these particles were still mobile.

This law, we believe, its author illustrated in the case of celts and flint-knives immersed in finely-divided silex powder; and if it is true at all,—and there are many other illustrations which might also be quoted,—it must be specially applicable to Egypt, where all the valley is composed of the so-called slime of the Nile, *i.e.*, microscopically fine particles of granite, porphyry, limestone, and the other rocks washed and rolled over by the mighty river in its long course from the equator.

Mr. Balfour Stewart's explanation of deep-sunk fragments of pottery in Egypt.

All these particles, moreover, are kept abundantly wet, and even visited every year by the inundation, which may be regarded as a grand tide of a secular order, producing amongst these small stones the same sort of lively quicksand effect, but in a superior degree, which is witnessed on our coasts, and more especially on the Goodwin Sands, whenever an ordinary periodical or only twelve-hour tide, rises there.

The geological evidence, then, for a very long chronology, under such circumstances, is specious in the extreme; while the astronomical is considerably worse, having even had a decided refutation given to its very essence, through means of recent hieroglyphical readings, and in this way. The painted Egyptian zodiacs already alluded to, had been fondly considered, by those who sought a high antiquity for Egypt, to have been

Astronomical argument for long chronologies.

Large assumption, in the so-called astronomical argument.

invariably constructed so as to represent the heavens as seen in their own day; and if they were found to have made the Equator crossing the Ecliptic 180° from its present position, that was taken as a proof that the ceiling, or the walls containing them, must have been sculptured when the Equator did cross the Ecliptic in that longitude; *i.e.*, 12,500 years ago, according to the known rate of the precession of the equinoxes in good Newtonian astronomy.

The assumption entirely hazardous and even baseless.

But this is plainly no scientific proof at all; for the mere picture may have resulted from either ignorance or design, as there needs neither art nor science merely to misplace the signs of the Zodiac; and any stone-mason can at any time, if you give him an order so to do, carve you a zodiac with the equator crossing the ecliptic in any constellation whatever.

Entirely refuted by recent hieroglyphical discoveries.

There was never, therefore, any real stability in the groundwork for these astronomical calculations; while during the last thirty years the whole of such false growth has been felled to the ground, by the successive discoveries of the new hierologists, Young, Champollion, and their followers; who have proved incontestably that the Zodiac-temples were the latest of all the Egyptian monuments, and dated only from the time of the later Ptolemies and even the earlier Roman Emperors; a

period when true Egyptian art had long since died, and there was only a weakly imitation of it kept up by State servants, to glorify the successive conquerors of the once noble and independent kingdom; and to lay at their feet either its latter ignorance of, or its knavery among, the stars.

Value of hieroglyphic science in tracing the history of Egypt.

Had hieroglyphical studies done nothing else than demolish the absurd antiquity given, on false grounds, to the astronomico-Egyptian temples, it would have deserved well of mankind; but it has done a great deal more, though perhaps not quite so much as its ardent students have claimed for it.

Rise of the modern knowledge of hieroglyphics.

Commenced by the discovery of the Rosetta Stone in 1802; vivified by Young and Champollion about 1820; and since most ably developed by Rossellini, Gardner Wilkinson, Birch, Gliddon,[1] Lepsius, Poole, De Saulcey, and many others,—hieroglyphical interpretation has rendered the nineteenth century vastly more intimately acquainted with the records of early Egypt, than any

American ambition in hieroglyphics.

[1] George R. Gliddon, taken as a child to the Mediterranean, and spending the earliest twenty-three years of his life continuously in Egypt, well exhibits the superior intellectuality and almost innate patriotism of the children of the Great Atlantic Republic; and, in his choice, so far back as 1843, of a "*mace*, indicative of military dominion" to represent hieroglyphically the letter m. of the word America, he intimated—in an age when Europe believed that his countrymen were utter preachers of peace doctrines, and opposers of all standing armies,—that which the years 1861-64 have shown was really in their heart of hearts.

nation, or people, or tongue, has been since the times of the very early Egyptians themselves.

Enthusiasm of the Champollionists.

The sudden ability thus acquired, to read the writings of a people who departed this life several thousands of years ago, and that writing written so clearly or carved so durably on the grandest of stone monuments, imparted extraordinary enthusiasm to the hieroglyphic students, especially those of the Champollion school, where it partook of the *élan* of a French cavalry charge.

Glorification of the Bunsenites.

In spite, however, of the grand promises they made, and the boastings they indulged in, as to the treasure-house of human wisdom which they had opened up, and their congratulations to each other, and to antiquity, on their success,—

> "Dark has been thy night,
> Oh, Egypt! but the flame
> Of new-born *science* gilds thine ancient name,"

—they have not given us yet any of the philosophy, or mental history of early Egypt, for such things in truth do not exist in the hieroglyphics. But Sir George Cornewall Lewis goes a great deal too far on the opposite side, when he makes sure "that there is nothing worth knowing in all the hieroglyphics yet remaining to be interpreted;" and when he "fears," in mocking charity, lest "the future discoveries of the Egyptologists be attended with results as worthless and uncertain, as

Lowered completely by Sir G. Cornewall Lewis.

those which have hitherto attended their ill-requited and barren labours."

Greek, *versus* hieroglyphic, scholars.

These views of his have been rather popular among many good Greek scholars; who, as Mr. Gliddon says, do not love, either to look on the ancient philosophers of Greece and of their own early studies, as only modern visitors to old Egypt; or to drop their own knowledge of the Grecian language in favour of the ancient Coptic, and more still, the pre-Coptic tongue, which they must learn like children, if they would read hieroglyphics in the original for themselves.

Merits certainly due to hieroglyphics.

The truth of the case, however, appears to be, that some inimitably exact, as well as extraordinarily ancient, laconic expressions, are contained in the hieroglyphic inscriptions; that special care was taken, and deference to accuracy paid by their authors, whenever they inscribed the name of the king for the time being, as they invariably did in a "cartouche" or "oval,"—easily distinguishable from every other name or word ever inscribed on any occasion,—and on every building erected in his reign. And that these royal mottoes, through all the more *recent* periods, read clearly the names of the well-known kings and emperors of the Greek and Roman empires; while, in *earlier* periods, they are generally identifiable with the several names

Manetho's royal names verified.

in the lists of Manetho, that erudite Egyptian priest who composed the earliest book-history of his country, for the benefit of its then Ptolemaic sovereign.

Forged hieroglyphics.

If, therefore, we only keep our eyes open to the possibilities of imposture in special instances,—as when the present men of Gurnou, in Egypt, reproduce the oval of Rameses the Great, in some soft material, to sell as a particularly precious relic to European tourists,—it is clear, that in remains of such a "grandly monumental" nation as the ancient Egyptians most peculiarly were, there do exist, if not a continued and coherent system, yet some undoubted materials of a chronology; materials, too, of such special purport, and so exceedingly numerous at a time when books were rare indeed, that the mass of mankind is not likely to regard for long any history or chronology of Egypt, which repudiates the employment of her own earliest and best-preserved data.

Place of hieroglyphics in chronology.

Of late years, too, there has been nothing extravagant in the dates, which some of the best hierologists have asserted for their earliest kings; for though they do slightly exceed the limits which would be assigned by the marginal dates computed by Archbishop Usher for our authorized Bibles, they are quite within what is allowed by the Septuagint version, and rebel against nothing of a spiritual nature.

Revised chronology of the hieroglyphics.

From various authorities, therefore, but chiefly from Sir Gardner Wilkinson and George R. Gliddon, the following table of Egyptian chronology has been prepared, which sufficiently illustrates at a glance the excessively early date of all the Memphite or Jizeh Pyramids; especially then of the Great Pyramid; together with its wide separation thereby from the Great Sphinx, and all those pictured tombs, obelisks, and columned temples of later times, which have too often been connected with it. So long ago did a prejudice for such a relationship exist, that Professor Greaves was pointedly assailed after the publication of his *Pyramidographia*, as to why he had said nothing about the Great Sphinx; though indeed one of his querists presently answers himself, by supposing that the Professor must have found at the place, that the said Sphinx had in reality no connexion with the Great Pyramid.

First striking deduction from hieroglyphic chronology.

The Great Sphinx utterly unconnected, in time, with the Great Pyramid.

Exceedingly right, too, was the querist in that supposition; for not only has the oval of a King,[1] one thousand years later than the date of the great Pyramid, been found unexceptionably upon the Sphinx,—but that monster, an idol in itself, with a wig and painted cheeks, and symptoms typifying the lowest mental organization, positively reeks with idolatry throughout

Essentially idolatrous character of Great Sphinx.

[1] "The fourth Thothmes, son of Amunoph the Second, of the 18th Dynasty of Thebans, the Augustan period of ancient Egypt:" according to

its substance; for when the fragments, or component masses, of its colossal stone-beard were discovered in the sand excavations of 1817, it was perceived that all the internally joining surfaces of the blocks had been figured, full of the "impure" Egyptian gods.

Contrast to Great Pyramid.

Strange, therefore, that Dean Stanley's professional eye should have seen in such a creature,[1] an *appropriate* guardian to the Great Pyramid, whose pure and perfect surface of blameless stone, eschews every thought of idolatry and sin.

Sir Gardner Wilkinson. Again, in the hieroglyphic tablet which figures in the small temple, between the fore-legs of the Sphinx, as given by Colonel Howard-Vyse,—the name is recorded many times, and usually thus,—

FIG. 5.

1 "Its vast projecting wig, its great ears, its open eyes, the red colour still visible on its cheek, the immense projection of the whole lower part of its face."—*Sinai and Palestine*, by the Rev. A. P. Stanley, Canon of Canterbury, page lviii.

TABLE OF COMPARATIVE CHRONOLOGY, APPROXIMATELY.

Scripture contemporary Names.	Hiero-glyphic years.	Egyptian Dynasties. Principal.	Subordinate.	Egyptian Monuments.	General Events.
	B.C.				
Deluge, . . .	3200	....	....	....	....
....	3100	....	....	....	....
....	3000	....	....	....	....
....	2900	....	....	....	....
....	2800	....	....	....	....
....	2700	1. Thinite, ...	....	....	Animals "appointed" to be gods in Egypt.
....	2600	3. Memphite, . . .	2. Thinites, ...	Pyramids of Lower Egypt,	
....	2500	4. Memphite, . . .	....	Jizeh Pyramids and tombs,	Kings Shofo and Nou-Shofo repudiate idolatry.
....	2400	....	5. Elephantines, . .	....	....
....	2300	11. Theban, ...	9. Hermanthites. . .	Sinai and other Quarries, .	Animal-worship restored.
....	2200	6. Memphite, . . .	....	....	....
....	2100	12. Theban, ...	14. Xoites, . . .	....	....
Abraham, . . .	2000	7. Memphite, . . .	15. Theban, ...	Memphite Pyramids,	....
Isaac, ...	1900	13. Theban, ...	10. ?	Tombs, etc., ...	....
Jacob, ...	1800	8. Memphite, . . .	16. Theban, ...	....	....
Joseph, . . .	1700	....	17. Shepherds, Hyksos	....	....
....	1600	18. Thebans, ...	returned? . . .	Obelisks, ...	All Egypt under one King.
Moses, ...	1500	....	....	Temples, ...	....
Joshua, ...	1400	....	....	Brick Arches, ...	....
....	1300	19. Thebans, ...	....	Great Sphinx, ...	Rameses the Great.
....	1200	20. Thebans, ...	....	Colossi, ...	Troy taken.
Samuel—David,	1100	21. Tanites, ...	....	Temple-Palace, ...	....
Solomon, . . .	1000	22. Bubastites, . . .	....	Tombs, ...	....
....	900	....	....	Karnak-Temple, ...	....
Isaiah, ...	800	23. Tanites, ...	....	Palaces, ...	Olympiads began.
....	700	24. Saïte; 25. Ethiop.	....	Syene Quarries, ...	Captivity of Israel.
Jeremiah, . . .	600	26. Saïte, ...	....	Stone Arches, ...	Nebuchadnezzar,
....	500	27. Persians, ...	....	Tombs, ...	Cambyses conquers Egypt.
Malachi, . . .	400	28. Saïte, 29, 30, & 31.	....	Meroe Pyramids, ...	Xenophon.
....	300	Greeks, ...	....	Luxor completed, ...	Alexander the Great.
....	200	....	....	Philæ Temple, ...	....
....	100	....	....	Esneh Zodiac, ...	....
....	30	Romans, ...	....	Dendera Zodiac, ...	Julius Cæsar.
	A.D.			Gebel Dokhan quarries.	
....	620	Arabians, ...	....		....
....	1517	Turks, ...	....	....	Casing stones removed from Great Pyramid.
....	1798	French, ...	....	....	The Porphyry Coffer, mischievously, and irretrievably, injured.
....	1801	Turks and local Pashas,	....	....	

CHAPTER II.

HYKSOS AND ISRAELITES.

Hieroglyphics entirely silent on the Israelites having sojourned in Egypt.

"THERE are not, in the hieroglyphics, any allusions to the Israelites through all the times from Joseph to Moses," say the most learned Egyptologists. In Theban tombs some pictures of "brick-making" exist, but the men employed are not Jews; and there must always have been abundance of brick-making going on in the land, as private houses seem to have been almost invariably constructed of that material, although stone was so abundantly employed on other occasions. The Israelites, too, says Sir Gardner Wilkinson, were never in the neighbourhood of Thebes, being confined to the Delta of Egypt, a district whose public monuments have not been preserved.

The hierologists then, at least, are no authorities on the captivity of Israel, nor generally are they, or can they be, on any subjects where there are not buildings

with hieroglyphics still existing. In Mr. Gliddon's very interesting and well-packed lectures on the Pyramids, he sets forth, that he is going to tell his audience, "not what one author has thought, or another has fancied, about the Pyramids; but what the hierologists *know* about them." Limits of hieroglyphic explanations.

What then, may we ask, *do* they know about them?

It seems to be chiefly confined to this very small compass, viz., that the names or ovals of various kings, some of the fourth Memphite, and other of earlier dynasties, agreeably with Manetho's lists, have been found in several of the Pyramids; and a certain comparative order of date has therefore been so far securely assigned. According to this, the third Pyramid of Jizeh is later than the second, and the second than the first, *i.e.*, the Great Pyramid; all below the size of the third, including the tombs around, being looked on as decidedly more recent than any of the large ones.[1] Hieroglyphics of the Pyramids generally.

The Great Pyramid, however, though the oldest of the Jizeh group, is not therefore quite the oldest in all Egypt. Its absolute date is supposed, Manetho-hieroglyphically, to be close upon 2500 B.C. (which sufficiently Date of the Great Pyramid.

[1] "This *Senófro* (or *Senofr*) has been placed by Dr. Lepsius before *Shofo* (*Suphis*); but as the position of these tombs is regulated by the Great Pyramid, *Senofro* was evidently a later king than its founder."—Sir Gardner Wilkinson, in Murray's *Handbook for Egypt*, p. 182.

Hieroglyphic and astronomical dates of Great Pyramid in good accord.

agrees with Sir John Herschel's pole-star passage calculation); and depends on the ovals of Suphis, or Shofo, and Nou-Shofo (identifiable also with the Cheops and Chephren of Herodotus), having been discovered by Colonel Howard-Vyse in the dark recesses of the "Chambers of Construction." Previous to this discovery in 1839 there was nothing whatever for the hierologists to claim, or form any conclusion upon, or pretend any right to interpret in the Great Pyramid; and, even subsequently, they can only allude to those names as contained in mere stone-masons' marks put on the rude stones with a "crayon" at the quarry, to serve for a sort of temporary guide to the builders at the Pyramid, as to how to make use of the stones when there. (See Plate XIX.; also p. 5.)

Plate XIX.

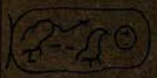
Why no hieroglyphics proper, on all the finished parts of Great Pyramid?

Yet let us accept the supposed hierological proof thereby depending, that those stones were certainly cut at the quarry in the times of Shofo and Nou-Shofo, and that the Pyramid too was built by them; and then ask, why were not hieroglyphics proper inscribed on any of the finished interior chambers, passages, and coffer, according to ordinary Egyptian example?

It was not because hieroglyphics were then only recently invented, and at that time only used in quarrier's marks; for, in one of the only two pyramids

PLATE 10.

SEE P. 580 CH. 2 PART V.



BY
HERBYAR BEY.

NAME
AS GIVEN BY THE
HIEROLOGISTS.

BY
LEPSIUS.

FROM A ROCK
IN THE
SINAITIC PENINSULA.

QUARRIER'S MARK
ON
ROUGH STONE.

BY
LEPSIUS.

FROM
GREAT
PYRAMID.

BY
HOWARD VYSE.

THE SAME.

thought by hierologists to be older than the Great Pyramid, hieroglyphic characters are signally employed, and in the more ornamental and demonstrative manner common to Theban and Ramesian times.

Ornamental and carefully sculptured hiero-glyphics in use before date of Great Pyramid.

The pyramid alluded to, is the greatest of those at Sakkara, almost nine miles south of Jizeh; is built in "degrees," or rude large steps; the general angle rather flat; the condition at present ruinous; the orientation many degrees from the truth; but over the doorway of a small internal chamber, at the end of a long descending passage, are, or rather were, until Dr. Lepsius cut them bodily away, some hieroglyphics, supposed to be older by far than any others yet discovered; and because, "the encircling line for the king's name is put after the letters expressing it, instead of round them; and a square, instead of oval, 'banner or title,' is employed."

Special example.

A view of this doorway is given in vol. iii. of Dr. Lepsius' plates. The hieroglyphics there seen, serve as continuous sculptured ornaments, of a very rich and artistic kind, along both sides and top of the door; and are a work equal in difficulty to the erection of the door itself. So large and necessary a feature, indeed, do they form in the architecture, that, if this pyramid be really older than the great one, the for-

mer question returns more strongly than ever, "Why were the internal portions of the Great Pyramid left so very plain?"

Most ancient of all the Pyramids?

The other reputedly more ancient pyramid is that of Aboo-Roash, five miles northward of Jizeh. But over this we cannot perceive that the hierologists have any hold at all; for there are but five or six complete courses of its stones existing above ground, we believe without any hieroglyphics upon them, and it is merely their "decomposed state" which is quoted, as an *appearance* of age; while Sir Gardner Wilkinson expresses a doubt whether "the building was ever finished."

Sum of hieroglyphic explanations of the Great Pyramid.

We are not thus placed, by the result and sum of hierological research amongst the pyramids, in any materially different position from that with which we opened the grand inquiry in our first chapter.

The Great Pyramid is not indeed quite the oldest, nor quite the northernmost of all the pyramids of Lower Egypt. It is not either very different from the others in its general figure or mechanical mode of construction, and might easily have passed for one of them to not very observant eyes, as well in its exterior, as its *subterranean* interior.

But to those who look with respectful care, there is a perfection of workmanship which leaves both its prede-

cessors and successors infinitely behind it,[1] not to say anything of a multitude of features connected with design, in all of which they have nothing in common.

Superior workmanship of Great Pyramid.

The mere practical building, then, as we have already said, might have been executed by Egyptian workmen. The actual performance also of all higher orders and aims, was certainly carried out by Egyptian methods and means; nay, even the planning of the subterranean portion was Egyptian also; but then who planned the upper part of the Great Pyramid, and made that division of it so totally opposed to Egyptian precedent in principle; and also secured that it should be carried out in practice, with such infinitely greater perfection than any other pyramid either before or since?

Unique planning.

Who superintended, or ordered it?

There the hierologists give no assistance; for though they may answer readily enough from their "ovals," "Kings Shofo and Nou-Shofo,"—they cannot say who

[1] The second pyramid is closest in age to the Great Pyramid, both in appearance and preservation; considerably more, indeed, of its casing-stones are still *in situ* (see photographic frontispiece, or Plate I.); but this arises from either the accidental neglect of the mediæval Caliphs, or from purposed neglect on account of the material having been found inferior, and not worth the trouble of carrying away. Where the outside casing *has* been removed, and the character of the substructure can be judged of, Sir Gardner Wilkinson has written as follows of it:—"The style of building in the second pyramid is inferior to that of the first, and the stones used in its construction were less carefully selected, though united with nearly the same kind of cement."—(For the condition of other Pyramids, see Colonel Howard-Vyse, vol. iii.; and Frith's large photographs.)

Inferior structure of second Jizeh pyramid.

were the persons bearing those names, or describe the nature of their thoughts, their experiences, and their rule.

Who, and whence, were the kings bearing the hieroglyphic names of Shofo, and Nou-Shofo?

It is not at all necessary that these kings should have been pure Egyptians, for there are many recorded instances of strangers dominating temporarily in one part or another of the long valley of the Nile; and that Shofo and Nou-Shofo were really such strangers, or foreigners, who obtained power over the Egyptians for a time, Sir Gardner Wilkinson evidently thinks quite possible;[1] and from vastly different grounds of belief to any that we have treated of, but which invariably tend in the same direction. Indeed when we duly consider all the points of difference in what was erected under the rule of those kings, and the rule both of their predecessors and their successors, the idea becomes almost certainty,—that, if they were not actual foreigners themselves, they must have been, for the time, under the complete mental control of some very foreign and anti-Egyptian influence.

Their anti-Egyptian ideas and deeds.

[1] "With regard to the notion that these kings were foreigners, arguments may be found both to refute and support it. The style of architecture, the sculptures in the tombs, and the scenes they represent, are all Egyptian; and there are no subjects relating to another race, or to customs differing from those of the country. On the other hand, the aversion stated by Herodotus to have been felt by the Egyptians for the memory of their founders, if really true, would accord with the oppression of foreign tyrants; other strangers who ruled in Egypt employed native architects and sculptors."—Murray's *Handbook for Egypt*, p. 184.

True, their names were painted on the quarry blocks in what has been termed the linear-hieratic language of the banks of the Nile; but precisely the same thing occurred to the Roman Emperors afterwards, and without the said Emperors being any the less of foreign tyrants, or less completely opposed to the degrading, mythological systems of the old Egyptians.[1]

Names of foreign Kings of Egypt, appear in hieroglyphics as though they were native.

So much as 1500 years after the erection of the Great Pyramid, Herodotus learned that its immediate directors or orderers, *i.e.*, the Kings Shofo and Nou-Shofo were so hated by the native Egyptians that they would never allude to them by name direct, but only by a periphrasis which carried with it an indication of a certain religious abomination; and Manetho, some centuries afterwards, shows that he kept up the hereditary feeling, and endeavours to write the early history of his country, in a manner without mentioning its chief features, and yet alluding to them. No little confusion therefore occurs as to actual names, times, and characters of different kings; though some all-noteworthy particulars do transpire, touching the real characteristics of a certain people who came into Egypt from the East, during the pyramid-building period, and went

Herodotus and Manetho on Kings Shofo and Nou-Shofo.

[1] Their worship of the bull, the crocodile, and other lower creatures, continued down to the time of the Emperor Constantine.

back there again; leaving behind them, perhaps, the accomplishment of the Great Pyramid; but certainly, an undying name of hatred to the idolatrous Egyptians, as "Hyksos" or "Shepherd Kings."

The Hyksos, or Shepherd Kings, in Egypt more than once.

Their "dynasty" is usually recorded, as closely preceding the eighteenth, and it may quite be, that the seventeenth dynasty was composed of some Eastern strangers, who, in that case, lived between the time of Isaac and Moses; but, that some Hyksos were earlier still, appear from several of the comparatively accidental illustrations afforded by Herodotus and Manetho; while, that the later Hyksos were not the altogether pure-minded men of the Great Pyramid, but worshippers of the sun, and perhaps idolaters in other forms, may be assumed from what Sir Gardner Wilkinson writes of the ruins at Tel el-Amarna:—

Characteristics of the second Hyksos.

"The royal names have been invariably defaced, evidently by the Egyptians themselves. Some have supposed that the kings whose names are found here belonged to the dynasty of the 'Hyksos,' or Shepherds; but this era does not agree with that of the Hyksos who invaded Egypt at the close of the sixth dynasty. They were evidently foreigners, who made a change in the religion by substituting the worship of the sun, as Atinre, for that of Amun, who was not restored until

the return of the Egyptian dynasty." "But though not the original 'Hyksos,' their invasion may be connected with 'the *return* of the Shepherds' mentioned by Manetho; and the attention of those who are interested in Egyptian inquiry should be directed to any records that may fall in their way respecting these foreign princes. From their features it is evident they were not Egyptians; their omission in the list of kings, the erasure of their names, the destruction of their monuments, and the abject submission they required, prove them to have been looked upon with hatred in the country; and the peculiar mode of worshipping and representing the sun argues that their religion differed from the Egyptian."[1]

Manetho's *return* of the Hyksos.

Hyksos, an essentially foreign nation.

Those later Hyksos then, were only comparable to the servant of Elisha, returning to plunder the riches, which his master had spared out of due regard to the Lord, and His glorification in the eyes of the heathen.

But about the earlier and true Hyksos, there hangs a majesty which is almost sublime. When "investigating the early history of the world," writes most appositely, though devoted to other modes and subjects of research, an eloquent author,[2] "the Hyksos cross our path like a

The original Hyksos.

[1] Sir Gardner Wilkinson, in Murray's *Handbook for Egypt*, p. 294.
[2] Mrs. Hamilton Grey's *History of Etruria*.

Their mysterious advent, and departure.

mighty shadow, advancing from native seats to which it baffled the geography of antiquity to assign a position, covering for a season the shores of the Mediterranean, and the banks of the Nile, with the terror of their arms and the renown of their conquests, and at length vanishing with a mystery equal to that of their first appearance."[1]

And yet this narrates but a small part of the wonder. To conquer merely by force of arms is a vulgar, a cruel, or at all events a human mode of gaining power over mankind, and one which many and many a conqueror has tried in his day; but Manetho says most pointedly of the Hyksos, and it probably applies rather to the earlier than the later,—"there came up from the East in a strange manner men of an ignoble race, who had the confidence to invade our country, and easily subdued it by their power without a battle." Manetho does not describe everything in the general period for which he writes, any more than do the hieroglyphics; for they are almost as silent of Hyksos as Israelites; but what Manetho does say of the Hyksos, is most extraordinarily like what he says of the Israelites, touching

Manetho's account of the unusual manner of establishment, of the Hyksos in Egypt.

[1] "Later investigations have rather increased than removed my difficulties; and, as a mere matter of argument, it would be indifferent to me to sustain, that the *Hyksos once occupied Lower Egypt;* or, that *they were never there at all.*"—Dr. Hincks, *On the Hieroglyphical Alphabet.*

the manner in which they were enabled to acquire power, and the first and chief use which they made of it when obtained. Josephus even believed that they were one and the same people and occasion; but his opinion has been completely overruled by all the mass of modern writers, as well as by both his, and Manetho's very early predecessor, the Phœnician Sanchoniatho. Josephus's interpretation of Manetho, incorrect.

The chief difference in Manetho's two accounts, after mentioning the totally different dates of the occasions, is,—that the Hyksos are always represented as warlike strangers arrived from a distance; as a powerful people with their own kings; a people never brought into subjection by the Egyptians; and though, after several reigns, they were much pressed by a valorous Egyptian monarch, they merely signed a capitulation to leave the country "quietly and entirely with all their people and goods; and did so leave it, going by way of the Desert towards Syria, where they built *Jerusalem*." Manetho's characteristics of the Hyksos.

But the Israelites, on the contrary, at the time of their rising under Moses, are represented as a people already in the land, an oppressed and despised people, stigmatized as leprous and unclean, and their chief was not a prince, but a priest, and subsequently a lawgiver. They are, moreover, represented as being forcibly driven out of Egypt by the Egyptian king, Manetho's characteristics of the Israelites.

Manetho on the Exodus.

large numbers of them being contemptuously slaughtered in the operation.

Manetho's patriotic weaknesses.

Comparing this account then with that in the Bible, it is evident that we must apply large corrections to Manetho's version of any event, when his human weaknesses could give him an opportunity of blackening his country's enemies, and converting a defeat sustained by his friends, into a magnificent victory over the foe.[1]

Manetho reveals unintentionally the purity of Moses' religion.

But when he declares amongst the misdeeds of Moses, under the Egyptian name of Osarsiph, that he made *laws totally opposed to those of Egypt*, and obliged his people by oath, "that they should neither worship the gods of Egypt, nor abstain from any of those sacred animals which the Egyptians held in veneration, but sacrifice and slay them all; and that they should connect themselves with none but such as were of that confederacy,"—we may well believe that this is a

Josephus's patriotic weaknesses.

[1] Equally rigorous deductions must be made from Josephus, whose patriotic ire completely runs away with his dignity and impartiality, when he discusses either Manetho's charge as to his countrymen having been the "unclean" of Egypt, or Apion's description of a disease they were afflicted with when in the Desert. Yet the task is difficult, for, with small exceptions, the only known fragments of Manetho's history bearing on the present case, are precisely those which are quoted by Josephus. It is important for an exact understanding to refer to him in the original Greek, and also to note the various readings given to Manetho's remarkable descriptions of the Hyksos by the various English translators, from Sir Roger L'Estrange in 1650, to Isaac Preston Cory of Caius College, Cambridge (second edition in 1832), whose collection of *Ancient Fragments* is a truly first class book for consultation.

Cory's *Ancient Fragments.*

description, through a very distorted medium, of Moses' glorious zeal for the one living and true God.

Similarity of religious sentiment amongst Hyksos and Israelites.

Now this is also a description, very nearly, of the sentiments and proceedings which Manetho attributes to the first Hyksos, in that "they demolished the temples of the gods of Egypt;" and when, as he says, Moses afterwards applied to Jerusalem, to the descendants of those early Hyksos,—they sent him an army which joined him "in his impieties, committed every kind of sacrilege, destroyed the images of the gods, and roasted and fed upon those sacred animals that Egyptians worshipped."

The Bible and Manetho.

No true believer in the Bible is likely to put any other interpretation on Manetho's account of Moses, when in Egypt, sending to the inhabitants of Jerusalem for assistance against the Egyptian king, than Manetho's own tradition of the similarity in religion of the original Hyksos, who he says built Jerusalem, and the subsequent Israelites.

Origin of Jerusalem.

At first sight it might be thought that the Bible is against his reported origin of Jerusalem altogether; for when the Israelites under Joshua eventually reached the promised land, they found Jerusalem in the hands of the infidel Jebusites; a city in fact of theirs, and held by them so stoutly that not until the time of David did

the Jews become possessed of it, or did it ostensibly begin to be the sacred city of the world.

Melchizedek King of Jerusalem before it was taken by the Jebusites.

But then, again, the Bible alludes, previous to the times of the Jebusites and Joshua, to Salem (considered to be Jerusalem) as under the kingship of Melchizedek, "the priest of the most high God, to whom even Abraham gave the tenth of the spoils," and who is established, both by the Old and New Testament, to be "king of righteousness." We can therefore hardly look on the Jebusites as other than later piratical holders of Canaan, who had merely obtained forcible possession of the holy city for a time; and that that city had been founded, and first governed by men whose religion was approved by the Almighty, and who were the Hyksos or "shepherd kings" of Manetho.

Melchizedek probably one of the Hyksos, or Shepherd Kings.

Their retreat from Egypt, according to a note of Whiston's, in Josephus, was forty years before the calling of Abraham out of Haran, and therefore perfectly suitable to the building of the city and the establishment of Melchizedek as its king, before the great battle in the Vale of Siddim. Those whom we may look on there as descendants of the Hyksos, went out, five kings, to war against four only, viz., "Amraphel, king of Shinar, Arioch, king of Ellasar, Chedorlaomer, king of Elam, and Tidal, king of nations," and were

beaten; but from the names of some of the five kings, we may well conclude that even at that early date their people had generally departed from the purer faith of their ancestors, and therefore success did not attend them in the battle.

The Hyksos Jerusalem may have been punished for its sins, by falling before the Jebusites.

From the general current indeed of Palestinian history, we may perhaps be allowed to conclude, that when the measure of wrath on the cities of the Plain was accomplished, Jerusalem had also erred; and to such an extent, as to be given up to be trodden under foot during a long historical night, by the Jebusites of the land.

Then probably perished the last of the Hyksos; and if so, they had performed their special part in Divine providence on earth; and, seeing that the Jews had by that time been separated for another and more spiritual purpose,—they, the Hyksos, could be spared.

The Hyksos built the Great Pyramid, and two very lasting cities.

But the city, as well as the Great Pyramid, which they had founded, live on still. Out of Egypt the Hyksos built no pyramids, but were allowed to be the founders of more than one lasting city; for if we may trust the third and fourth books of the old Phœnician chronicler Sanchoniatho (B.C. 700), as rendered to the world from a Greek MS. by M. Wagenfeld,—the city of Damascus, of which the Bible makes contemporary mention with Salem and Melchizedek, was founded by Damascon, a

Damascus and the Hyksos.

chief, but not the principal chief, of certain pastoral tribes who "were driven out of Egypt a very long time before the emigration of the Hebrews from thence;" or in other words, by the Hyksos.

The Hyksos, a Shemitic people, with a capacity for building;

Take them therefore according to almost any ancient authority, the Hyksos were connected with some of the most remarkable practical works on the face of the earth; works that have in them more of a lasting destiny than usually follows the free designs of men, even for the express purpose of immortalizing their names; as seen in poor Absalom's tower. And we have also, it is plain, in these Hyksos, a people who not only came out from, and went back to, Syria and its territories of the descendants of Shem; but individuals of that stock, who, though existing long before the time of the calling of Abraham, or the propounding of the law under Moses, yet lived, as directed by some of the earliest of their rulers, in remarkable accordance with the teachings of that sacred law; and were recognised, even by their enemies, as being of a similar way of thinking, in spiritual things, to the subsequent Jewish lawgiver.

Of a religious tendency, agreeably with the best of the Patriarchs;

This indicates therefore precisely the class of early patriarchs, to whom it pleased the Lord to grant occasional revelations of His will, and to lay His commands upon them for special purposes. Often, amongst others,

by the direct teaching of sundry useful arts to hasten the growth of civilisation, and quicken man's development out of either pristine savagedom, or the primeval ignorance and infancy, which,—but for such miraculous assistance,—might have, according to many secular authors, oppressed him through ages as long as those of geology, or for something like infinity of time.

And living in the day of frequent Divine revelations in common things.

Did He then instruct the Hyksos branch of those patriarchal houses to go down to Egypt on that first remarkable occasion, in the time of the fourth Egyptian dynasty; was it His almighty arm which enabled them, though they were said to be men of "ignoble race, and small stature, to overcome the Egyptians without a battle;" and was the plan of the Great Pyramid, in its universal metrological bearings, "a thought above their thoughts," inspired from on high into their minds?

Were the Hyksos inspired to build the Pyramid?

The mere names of Shofo and Nou-Shofo are undoubtedly Egyptian words which we need not look for in the Bible; but as "Hyksos" was somewhat assisted to our scriptural understanding by Manetho's interpretation of "the Shepherd Kings,"[1]—so may be "Shofo" by Herodotus' tradition of the name of the first and prin-

Were Shofo and Nou-Shofo the Egyptian names of two Hyksos kings?

[1] "But his (Joseph's) bow abode in strength, and the arms of his hands were made strong by the hands of the mighty God of Jacob (from thence is the Shepherd, the stone of Israel)."—GEN. xlix. 24.

Light shed on their origin by the very hatred of the Egyptians.

cipal builder-king, being concealed in the statement that the site of the Great Pyramid was, where "the Shepherd Philition, or Philitis, fed his flock;" for the word "Philition" draws in its train, the subsequent sacrifice-feasts of the Jews, the ἀγάπαι or love-feasts of the Christians;[1] and the remembrance of the Lamb slain from the beginning of the world; a sacrifice of a sin-offering for man; and the beginning of repentance, submission, and all true religion; though indeed always a cause of offence, a *stone* of stumbling, and even an abomination to the unfortunately conceited and egotistical Egyptians.

These inferences too, from names and words, gain continually in strength, when compared with traditional history, or existing material facts.

Why did the Egyptians so especially hate Shofo and Nou-Shofo?

For well may we ask, why, or wherefore all this extraordinary hatred amongst the Egyptians, against Kings Shofo and Nou-Shofo? "Because they made the people labour on such a huge and useless mass, as the Great Pyramid of Jizeh," answer some noteworthy authors. Yet not with the best of reasons; for there were multitudes of other pyramids in Egypt (and some of them very nearly as big as the Jizeh mass), built by other, and positively native, kings; who remained, not-

Not merely because they built the Great Pyramid;

[1] Taylor's *Great Pyramid*, pp. 212-220.

withstanding the building, rather favourites, than objects of detestation, with the inhabitants of the land.

But because they put down the Egyptian idolatry.

Building a pyramid, was in fact anything but a crime in the eyes of that "monumental" people; but this is what they did not forgive, viz., that King Shofo (Cheops or Suphis) "overthrew their temples, and was the first who put a stop to the sacrifices." King Nou-Shofo (Chephren) afterwards continuing, or at the time assisting in, the same regime; and this, the Egyptians term "inflicting on them every kind of evil."[1]

Conclusions to be drawn from the praise, or the blame of bad men.

Some very good men amongst the moderns, without weighing well from whom this testimony comes, and without considering the reverse teaching of that sacred warning, "Woe unto you when all men shall speak well of you! for so did their fathers to the false prophets," describe these two kings as "given over to every kind of profligacy and wickedness;" but had such been their characteristics, they could not have methodized and steadily employed the industry of a primeval nation through a long period of years, so successfully, as to have produced at last, in the Great Pyramid, the largest and best built monument which the earth has even yet to show. We confine the claim of those kings to the Great Pyramid; for although Herodotus gives the build-

[1] Herodotus, in Cory's *Ancient Fragments*, p. 155.

Shefo and Nou-Shefo's acts disprove the abuse of the Egyptians.

ing of the second pyramid to Nou-Shofo, his name appears as abundantly in the quarry marks of the Chambers of Construction of the Great Pyramid, as that of Shofo; and there are many assertions of their being two brothers, reigning jointly; explaining in that manner how two brothers could reign, one of them fifty, and the other fifty-six years, and further adding that Nou-Shofo, the younger, died first: while their characters and actions do not appear to have been shared by any of their predecessors, or followers.

Shofo and Nou-Shofo of the same faith as the Hyksos, and Moses.

The sort of profligacy and impiety then, with which Shofo and Nou-Shofo were accused by the Egyptians, was after all only founded on precisely the same acts of interfering with the indigenous religion of Egypt in impure bulls, and goats, and lower animals, which they laid to the charge, in very similar terms, of both the Hyksos, and afterwards the Israelites under Moses.

Shofo's "arrogance against the gods," opposite to that of Caligula.

Manetho further accuses Shofo (Suphis), "of being arrogant towards the gods;" and how was that arrogance manifested? Not as was the arrogance of the Emperor Caligula in subsequent times, in the very same land of Egypt, where he wanted to put his own statue into every temple as a chief god amongst the gods,—an impious and tyrannical proceeding, whose danger to his nation, Josephus so much deplores,—but, as we see

now in the Great Pyramid; by preventing the introduction or establishment therein of any false gods, or sculptured figures, or painted emblems of them whatever; even though the labourers employed, were the bigoted worshippers of such.

The Pyramid Kings were Hyksos in heart at least;

Surely this fact, which all men may test for themselves even still, puts the crowning confirmation on the long list of deductions with regard to these two kings Shofo and Nou-Shofo, hated by the Egyptians with all the hatred wherewith they hated both the Hyksos and Israelites,—and proves that they, the said two kings, must have been thoroughly Hyksos in heart, if they were not also in birth and descent.[1] Indicating too, that they were possibly, on that account, no unworthy instruments to be employed in working out in material form, an intended Revelation of the Deity to man; in an age, we must by no means forget, nearly 900 years earlier than the epoch of the first *written Revelation.*

And lived long before the age of the first written Revelation.

In that very early and pre-Mosaic period of the Pyramid, the subsequent written Revelation, in its retrospective historical portions, teaches us that there were frequent Revelations vouchsafed to chosen men. There is therefore nothing unscriptural in imagining a

[1] Plate XIX. indicates how much more perfectly the names of these kings were cut on certain mountains in the Sinaitic peninsula, than in any published representation of Egyptian monuments.

Was the Pyramid a pre-Mosaic material inspiration?

Revelation to have been made before the time of Moses; the only doubt is, whether its traces might be expected to last for many thousands of years, and whether the Great Pyramid does really embody them: difficulties, which may be perhaps satisfactorily inquired into, by considering—firstly, whether the scope of such a revelation is acknowledged in Holy Writ; secondly, whether its nature and objects would require a permanence of manifestation to render them useful for the ends to which they were directed; and, thirdly, whether the Great Pyramid responds to all the required conditions.

And was it intended to last to these days?

CHAPTER III.

SUPERIOR TESTIMONY.

Bible notices of the importance of metrology.

THAT metrology at large was a subject not beneath the dignity of Divine attention in the earlier ages of the world, appears sufficiently from the following commands issued by direct revelation, in subsequent times, to the particular people, in these words: viz., "Thou shalt have a perfect and just weight, a perfect and just measure shalt thou have; that thy days may be lengthened in the land which the Lord thy God giveth thee."[1]

And again,

"A false balance is abomination to the Lord: but a just weight is his delight."[2]

Or,

"A just weight and balance are the Lord's; all the weights of the bag are his work."[3]

[1] Deut. xxv. 15. [2] Prov. xi. 1. [3] Prov. xvi. 11.

And with extraordinary force and distinctness,

"Ye shall do no unrighteousness in judgment, in mete-yard, in weight, or in measure.

"Just balances, just weights, a just ephah, and a just hin, shall ye have: I am the Lord your God, which brought you out of the land of Egypt.

"Therefore shall ye observe all my statutes, and all my judgments, and do them: I am the Lord."[1]

Perfection of metrology a necessity to civilized nations.

Since then mankind has abundantly recognised, and never more acutely than in the present century, that perfect weights and just measures are practical essentials to all men in carrying out their duties, as neighbours to their fellow-men; and that without such means, commerce cannot flourish, or certain justice prevail, or the repose of confidence and trust of faith be felt in carrying out the accomplishment of even the daily affairs of life.

Mankind, though often trying, have not reached either unity or perfection in metrology.

Hence have arisen all the efforts of modern science and modern legislature in every civilized country to devise the best possible scheme of practical perfection in metrology. Yet though they have laboured long and well, the subject is one of such vast capability, that perfection seems still as far off as ever from them all, even in this latter half of the nineteenth century, A.D.;

[1] Lev. xix. 35-37.

while every country that has up to this time considered the matter originally for itself, has brought out some different solution, the accuracy and sufficiency of which is not fully admitted by its own sons, and is generally very violently attacked by all other peoples.

Importance of a general metrology.

Even were the question settled, too, for any one nation within its own borders, there is the further and vastly more difficult problem still to be solved, of uniting all mankind under one metrological system, as tending eminently to produce results economical of human labour, and influences promotive of peace and good-will to all men.

Two great national divisions, in metrology.

Yet, amidst their several diversities, the kingdoms of the earth are in this matter clearly divisible into two well-marked classes; viz., those who hold to the weights and measures imperfectly handed down to them by tradition from early times, merely seeking to improve any weak points about them according to the teachings of nature and the aids of art; and those who glory in abolishing every trace of the ancient system, while they seek to substitute one of modern and entirely human invention, and which has not yet attained even the average length of a single human life.[1]

[1] The French metrical system, introduced in 1792, and established by law in 1837.

Ambitious promptings in metrology.

A magnificent occupation no doubt, viewed simply in itself, and if the field were still perfectly open, would it be, for any set of men to devise a metrological system for all peoples under the sun; to prepare a badge for every nation to wear; and to lay down the terms in which all posterity shall deal with the materials of God's creation through the whole of future time.

Praise bestowed on the efforts of French philosophers.

Immense praise has accordingly been given in many quarters, to "those great and noble-minded men of France," who have laboured both to devise such a system, and to get it by any means and all means introduced among other nations. No doubt too, those men were favoured with high intellect, and their exertions or their manner of working in their self-assumed cause, have been exemplary in the highest degree.

Are the French efforts in the right direction?

But what if their cause be not the right one, and if all their intellectual strength be employed in promoting that which, to say the least, is quite unnecessary, and may be perverse and even unholy? Already has a part of their system broken down under this point of view; for it has been found over Christendom at large, that

Certainly not in measures of time.

man required no better an arrangement of days for toil and rest, duty and praise, than a week of seven days; and the Parisian attempt, rather more than half a century ago, to establish a decade of ten days in the week's

place, has been proved not only unnecessary, but a flagrant case of mortal man presuming to interfere with the commandment of his Maker.

This important judgment was given effect to, by our fathers in the last generation; and now it has happened to us of the present day, and fallen upon our times, that we are bound to come to a conclusion on the remainder of that human-devised system of universal metrology. For, unabashed by what has befallen their measure of time, its authors or their successors in France are now pushing forward the remainder of their inventions for the reorganizing of our measures both of space and density; and if their trigonometrical survey for their metre-length has recently been found erroneous, so that in fact their metre is no longer sensibly a metre; and their standard temperature of 0° Centigrade, be upset in one way for the length of their scale, and another way for the density of the water employed; and their mode of computing the temperature-correction be proved erroneous; and their favourite natural reference of a quadrant of the earth be not found a scientific feature capable of serving the purpose they have been employing it for; and even if their own sons show some dislike to adopting it fully, and will adhere to as much of the ancient system as they can, in spite of pains and

Are they more correct in matters of space?

Necessary for the men of present day, to form a conclusion on this point.

Means being taken to urge and control them.

penalties,[1] and scientific reasoning,[2]—all this seems made only the more urgent use of by them, to get their system instantly established in other countries as well as their own, to the exclusion and oblivion if possible of the ancient measures of every land and people.

Frenchmen's ideas that England ought to adopt their measures.

But England, which was justly horrified at the former sacrilegious treatment of the week, and the abolishing of the Christian era, has not yet succumbed on this residual question; and will not yield, it is to be hoped, though the indignation of the French people at her resistance be expressed louder still, than in their recent comments on the partial entrance only, allowed to their metrical system in England, by the discussion in the House of Commons on May 4th of this year.[3]

Continued repugnance to the metre, by many Frenchmen.

[1] "The Chamber of Commerce of Dunkirk complains of the repugnance of a considerable number of commercial men to using the metrical system in their transactions with each other, though that system was made obligatory by the decree of the Convention seventy years ago, and again by the law of 1837, and that penalties are incurred by the non-observance of it. The Chamber of Commerce further recommends the other Chambers to take care that the law, 'which is not sufficiently observed,' shall be carried out; meaning, no doubt, that these penalties shall be enforced."—Paris Correspondent of (*London*) *Evening Mail*, June 15, 1864.

[2] In a correspondence between M. le Verrier and M. le Maréchal Vaillant, French Minister-at-War, which appeared last February in the daily "Bulletins" of the Imperial Observatory of Paris, discussing the laws of Meteorology, and the passage of storms over Europe,—the distances of places were mentioned on several occasions in "leagues," a term for distance which would seem even still to be more expressive of reality to scientific Frenchmen, than metres or kilometres.

[3] See the *Journal des Débats*, June 13, 1864, wherein *Le Secrétaire de la Rédaction* endeavours to organize public opinion appropriately to the re-

The defeat of the French and Anglo-French desires, however, on that occasion, was hardly so much from the vigorous opposition offered to them, as in the existence of a certain natural law, which seems to declare,— Law of principle in the establishment of a new metrology.

discussion of Mr. Ewart's pro-French-Measure Bill, which he expects to take place in a few days before the British House of Commons. Annoyed, like Messrs. Ewart, Cobden, and their friends, and considering, almost in their very words, himself and countrymen specially aggrieved that the bill was not passed on the former occasion, after it had received "the usually decisive proof of a second reading," the Secretary refers the defeat (or rather the smallness of the success gained by the pro-Gallic party, for he acknowledges they did get a something towards supplanting, on English soil, the English measures by French), to the ill-will of the present British Ministers: who, to gain "the frantic applause of the mob," and profit by "the eccentricities of an irregular patriotism," have departed, he says, from all the great and good examples of Canning, Peel, and Aberdeen, abusing everything that is French, and placing England in a painful condition of isolation in the midst of Europe. French method of legislating for England.

It is evident also to the French writer, that neither British ministers nor public—understanding or caring for the interests of their parish schoolboys and the facilitations of English commerce,—he, the Frenchman, is required to show them how they ought to perform those duties;—and then it oozes out pretty clearly, that if the British nation does not very soon adopt, in place of their own, all the French weights and measures, there will be a serious crime to be atoned for by England against the honour of France, and of "her glorious Assemblée Constituante of 1789."

On similar principles, if the trade-before-all-things merchants of the House of Commons were to bring in a bill for abolishing the English, in favour of the French, language,—insisting strongly on the convenience they would find in their counting-houses in not having two languages to deal with,—the British Minister who should venture to oppose such a change would infallibly fall under the grave displeasure of France; but the British *savant*, if one such could be found, who should advocate the bill, would be complimented in the French papers as the most learned *physicien* in all Albion, and the truest patriot that country has ever produced. National metrology, and national language.

For, says the *Débats*, "l'honneur de l'Angleterre est à ce prix!"

Yet when will the wise men of France incontestably prove the superiority of their science over both Nature, and the heritage of gifts to man in primal times,—by inventing a perfectly new language, completer and better than their own traditional tongue?

that in a matter of weights and measures, it is of no use giving written instructions, unless an actual standard can be exhibited at the same time.

This law does not apply to the commandment of the seven days for a week, or the fifty years for a jubilee, because the diurnal and annual movement of the earth mark out the unit day, and year, in the same manner for every man of every tongue and every nation.

Example of its force, illustrated unexpectedly in the House of Commons.

But in length, capacity, and weight, that law holds peremptorily; and, accordingly, when after two readings in the British House of Commons on the 4th of May 1864, Mr. Ewart's bill (for introducing the French measures) went into Committee; and its friends considered it triumphantly safe, because it had been "twice," they said, "affirmed by the House,"—yet it crumbled into dust at the mere testing touch of one speaker on the opposite side, who simply desired to see an example of the measure which the innovators wanted to legislate about, but were not able to show him.

They were very ill-disposed to accept that defeat, but could not resist the wisdom which pointed out to them, and made them in so far wiser than they were before, that the constructing of a perfect and just standard is the beginning of metrological legislation.

Now, it is not a little remarkable that this truth, only

impressed a few days ago on the British Legislature,[1] is that which was carried out integrally and perfectly, in the length of time by which the establishment of the Great Pyramid and its standards preceded the Mosaically written laws with reference to the use of those standards afterwards, in "length, weight, and measure." It is also exhibited in the practical example, by which, Moses having once received into his care the *sacred cubit*, took additional precautions for multiplying its copies and derivatives, so successfully preserved by his countrymen through fifty generations; that sacred cubit being, in fact of length, as already proved, the unique smaller linear standard of the Great Pyramid.

Earlier example at the Great Pyramid;

and in the Mosaic laws subsequently promulgated.

Consequently, although systems of weight and measure must be considered, abstractly, rather matters of mundane morality than religion; yet as they were to be in a following age legislated on Divinely to the selected and peculiar people, there must have been a deep interest among all religious spirits in the early establishment of the building which was to form the practical preliminary to such a legislation. Indeed it may be confidently affirmed, that in retrospect, as well as prospect, of that eventful beginning of the grandest of schemes, a remarkable degree of regard towards the

The Great Pyramid regarded by inspired writers, as a prelude to the laws given through Moses.

[1] See leading article in the *Times* newspaper for 5th May 1864.

Pyramid has been expressed by inspired writers of both the Old and New Testaments, and felt also by holy men described therein; besides an astonishingly intimate acquaintance being manifested with the characteristic features of pyramidal structure; while the honourable occasions on which it is referred to, under prophetical images or poetical figures, may impart to us also salutary and improving advice as to the thoughts we should connect with its existence and purposes.

Old Testament allusions to the Great Pyramid.

Those descriptions and references are usually invested with much of the mystery of a "parable," but in many cases yield to slight exertion. Thus, when we read in Job, chap. xxxviii., marginally corrected, "that the Lord answered him out of the whirlwind," and said:—

"Where wast thou when I laid the foundation of the earth; declare, if thou knowest understanding.

"Who hath laid the measures thereof, if thou knowest? or who hath stretched the line upon it?

"Whereupon are the sockets thereof made to sink, or who laid the corner-stone thereof?

"When the morning-stars sang together, and all the sons of God shouted for joy?"

Creation of the earth under a type of building.

It is quite plain, in the first place, on reading these words, that if the creation of the earth is here alluded to, it is described under a type of something else, and

not as the earth really was created; both as we know it by modern science, and as it was described in chap. xxvi. of the same book of Job, in the following words:—

"He stretcheth out the north over the empty place, and hangeth the earth upon nothing."

The earlier part of the first-quoted description might apply to the building of any ordinary house; but as successive practical features are enumerated, the building of a stone pyramid by careful measure, on a prepared platform of rock, is the only work that will fully correspond. The stretching the line *upon* it, is more applicable to the inclined surfaces of a pyramid than the vertical walls of a house; but what was meant by "the sockets thereof being made to sink," might have been uncertain, except for the researches of the French *savants* at the Pyramid in 1800; and they described, without any reference to this passage, the remarkable sockets which had been formed in the previously levelled area of rock on which the Pyramid stands, at each corner; and the manner in which each of the lower four corner-stones of the Pyramid were fitted in to these prepared hollows in the rock. They were shallow, but evidently cut in with so much care and truth that the *savants* immediately saw that these were the points from which they ought to stretch their measuring-line

The type of building applicable to the Pyramid;

and to that only.

upon the building; and on doing so, they were rewarded with the best determination of its size that any one mensuration has yet obtained.

Of the fifth, and chief corner-stone.

Four, of the five corner-stones of the Pyramid, are thus disposed of; and the fifth, which is in fact of an entirely diverse nature, being, not one of the foundations, but the topmost portion of the whole building, is alluded to in Job separately; and also, as something perfectly distinct from the others, as well as being the finishing and crowning part of the whole operation. When that corner-stone, emphatically called "*the* corner-stone," is finally placed, it is said that the act was greeted by "the morning stars singing together, and all the sons of God shouting for joy."

Joy on the completion of the building.

Who were those who expressed joy?

The Biblical interpretation of the personages here alluded to is, of course, "the faithful and the true converts;" "as many as are led by the Spirit of God, they are the sons of God." And all such who were present at the time, rejoiced in seeing the completion of the Great Pyramid; and their cry was, "When the *head-stone* of the *great mountain*[1]

The mountain-simile proved suitable to the Pyramid.

[1] How suitable the term "Great Mountain" is to the first Pyramid of Jizeh, the following extract from T. Sopwith's *Notes on Egypt*, pp. 161, 162, affords an apposite illustration:—

"The ponderous rocks—for that term conveys a better idea than that of the stones of a building—the ponderous rocks, in partial ruin, and showing here a bold projection and there a deep recess, form the foundation of

was brought out with shoutings, 'Grace, grace unto it.'"[1]

Then from a practical worker like St. Paul, we have even a still more methodical illustration, in the use which he makes of certain constructive differences between the four lower corner-stones, and the single one above, in the Pyramid; for he says:—"Ye are fellow-citizens with the saints, and of the household of God; and are built upon the *foundation* of the apostles and prophets, Jesus Christ himself being the *chief corner-stone*, in whom all the building, fitly framed together, groweth unto an holy temple in the Lord."[2] New Testament allusions to the Great Pyramid.

This fitly framing of the whole building into one corner-stone, which is called the chief and upper corner-stone, is an unmistakable allusion to the Pyramid; and this noble figurative employment of that particular stone, viz., its representation of the Messiah and his Symbolization of the chief corner-stone.

an inclined wall of masonry. . . . Its area—that is to say, of one side only—is more than five acres, a corner view thus presenting an area of stone walling on the two sides of nearly eleven acres. Its cubical contents are about eighty-five millions of cubic feet. This can only be comprehended by using some unit of comparative size more familiar than millions of cubic feet. Suppose a block of solid masonry, the length, breadth, and height of a moderately sized sitting room, say, for example, twenty feet by fifteen, and ten feet high. Of such blocks more than twenty-eight thousand three hundred and thirty would be required, and placed lengthways they would extend over more than one hundred and seven miles."

[1] Zech. iv. 7. Again a prophetical figure employed to represent the Messiah, but derived originally from, and founded on the Pyramid.

[2] Eph. ii. 19. See also Mr. Taylor's *Great Pyramid*, pp. 208-243.

crowning the scheme of the redemption of His people, is one frequently employed in Scripture; as in Psalm cxviii. 22, in the Gospels, and the Epistles.[1] It is alluded to not only as the chief corner-stone, "elect and precious," made the "*head* of the corner," that is the topmost angle of the Pyramid; but as having been for a long time "disallowed by the builders," and existing only as a "stone of stumbling and a rock of offence to them."

Origin, and application of the type.

The simile has suited the circumstances of our Saviour's appearance on earth so perfectly, that it is confined now, and understood almost entirely, amongst Christians as originating and in force only there. Yet evidently, from the very principle of all such figurative allusions, a something bearing on the nature of the figure made use of, must have been existing on the earth before, or it would never have been employed.

The Pyramid earlier than any of the inspired applications of the type.

Now we know that the Great Pyramid did stand upon its desert hill, before any of these inspired authors wrote; and also, that they seem to have been spiritually conversant with the principles of its construction, although they were not visitors to the land of Egypt: and it is they, who allude, in the Spirit, to some notorious objections against the head corner-stone, whatever that was originally, until finally erected into its place.

[1] Matt. xxi. 42; Mark xii. 10; Luke xx. 17; Acts iv. 11; 1 Pet. ii. 4.

Does this account then, apply to what we may conclude from other sources, touching the head corner-stone of the Great Pyramid?

The stone of stumbling and rock of offence.

Most pre-eminently so. For the workmen employed there, are proved by their quarry-marks to have been Egyptians; and though they may have had practice in building some sepulchral pyramids for Egyptian masters before, yet as those pyramids, in so far as the hierologists think they have yet made them out, were only "pyramids of broad degrees," or terraced-top things not much better than those of Mexico,—their builders never knew what a head corner-stone for a true and perfectly finished pointed pyramid really was.

No head corner-stone in the oldest Egyptian pyramids.

But all the stones required for the building of the Great Pyramid, were evidently prepared at the quarries according to orders given a long time beforehand. For the vast majority of stones, too, nothing but one unvarying figure, rather flattish and rectangular, was required; but amongst these, and different therefrom, one was prepared, according to orders from unknown authority, which did not chime in with any of the Egyptian building notions. In place of being cubic, or with parallel sides and rectangular corners, this single stone was, to a certain extent, triangular; and could not be introduced into any one of all the courses of the build-

The upper corner-stone anomalous amongst all the building stones at the last Pyramid.

ing; it was, indeed, all sharp points; for, turn it over on any side on the ground, one sharp corner was always sticking up in the air; and it acted thus, because it was necessarily a sort of model pyramid in itself, with five sides and five angles.[1]

Mechanical characteristics of that stone alluded to.

Such a stone must have been a very inconvenient mass amongst the workers at the base of the Pyramid; their "stone of stumbling, and rock of offence,"[2] "the stone set at nought by the builders"[3]—the pointed stone, "on which whosoever shall fall shall be broken;" and the huge stone, as a capping for the vast structure of the whole Pyramid, that, "on whomsoever it shall fall, it will grind him to powder."[4]

Effect of seeing it raised into its intended position.

Yet when once this strange five-cornered stone was raised up to its place on the summit of the Great Pyramid, the propriety of its figure must have appeared evident to every beholder.[5] The Egyptian workmen

[1] Taylor's *Great Pyramid*, p. 262-275. [2] 1 Peter ii. 8.
[3] Acts iv. 11. [4] Matt. xxi. 44.
[5] Amidst the general resemblance which undoubtedly prevails between ordinary pyramids and the Great Pyramid, it is useful to note all instances of decided difference; and one such, in addition to the several already discussed, is indicated by Dr. Lepsius' "theory of Egyptian pyramid-building:" for, according to that theory, which may be trusted for illustrating the customs of pagan Egypt, the headstone of an *Egyptian* pyramid was raised to its place on the top of the structure, as a *rectangular block;* and was then finished off with diagonal sides, and a pointed summit, as it stood *in situ;* see Plate IV. p. 78. A most radical difference in practice, to that which obtained at the Great Pyramid.

could then no longer complain of its mechanical inconvenience to them, as they had done before; though they persevered, as may be gathered from the remarks of Herodotus, in concealing sinful hatred in their hearts. But the "sons of God," on the other hand, rejoiced with free rejoicing to see that day; while the Hyksos kings and royal brethren greeted the completion of that most peculiar and nobly-destined temple, with the faultless cry of "Grace, grace unto it."

Impression on the minds of righteous men.

What salutation to a structure of stone in a heathen land, was ever so free from all idolatrous allusion! and what edifice is there even still in such countries, which is equally pure from the defilement of base-born mythologies, with the interior of the Great Pyramid, in the station which it yet occupies near the centre of the land of Egypt!

CHAPTER IV.

PREPARATIONS FOR UNIVERSAL METROLOGY.

Principles of legislation in metrology.

THE progress, then, of human science, and the accumulations of political experience from the earliest to the present day, though they have failed in enabling any nation to furnish itself with perfect metrological apparatus, have yet succeeded in laying down some sound general principles of procedure. And these principles, on being duly collated, are found eminently to add their testimony to the reasonableness of all we know concerning the sacred metrology; therein and thereby "justifying the ways of God to man," and proving that both the fact and epoch of the Great Pyramid's foundation, *ought* to have preceded the giving forth of the law containing the clauses already cited.

For truly it would have been little short of absolute condemnation, in such an early and pre-scientific age as that of Moses, to have commanded a young people,

composed chiefly of mere shepherds and lately slaves, to employ, under pain of the severest penalties, "a perfect and just weight and a perfect and just measure,"—without showing them withal, in a practical manner, what did really constitute the perfect, the just, and the true in subjects of that nature. Now it was precisely that, which the Pyramid, or rather in the Jewish case the standards extracted from it, did accomplish; and after such a beginning, legislation could properly follow. How satisfied in case of the Jews.

For the resulting legal system, however, to keep up its theoretical propriety, and maintain its practical usefulness, there is absolute necessity that the material examples of any legalized measures shall likewise continue in parallel existence; for the mere promulgating of laws for such things does not supersede the things themselves, but rather renders their constant presence and permanent facility of reference all the more requisite. Yet, on the other hand, it pretty clearly follows, that there is no particular need for the standard measures being maintained in convenience of access much longer than the life-term of those laws, to give point to which, the standards had been created. Continued requirements through all the duration of the laws.

Now the laws of Moses came to an end with the introduction of the Christian dispensation; and had the Great Pyramid been intended solely for the metrology How long Moses' laws lasted.

How long the Pyramid.

of the Israelites, the huge building need not have continued in existence during the last 1800 years. Yet it has lasted, and has recently been found to contain, over and above what concerned the Jews, some things which they never demanded or cared to know about.

Pyramid contained much over and above what the Jews knew of, or cared to know.

There were the features, for instance, which, by the interpretations of modern science, are made to prove the more than human perfection of the metrology of the Pyramid. To have had such features presented to the ancient Jews, would have been of no use to those who had no modern science; and for Hebrews again to have been specially enabled to appreciate the case in that manner, would have been a decided proof of supererogation, in times when that people were being favoured from on high with continual direct revelations of knowledge: besides which, the opening to them, in their day, of the interior of the Pyramid, for their own personal examination, would almost assuredly have entailed the destruction of its more precious parts in an early stage of the history of the world.

But that the Jews, or rather the Hebrews, of the stock of Abraham, without expressly visiting it, received their due share of the practical helps of the Pyramid,—probably by the hands of the Hyksos, when they returned from the building,—seems to be proved by Sir

Isaac Newton's determination of the "Pyramid-length of their sacred cubit;" and by Mr. Taylor's deduction of the value of their chomer; viz., that four of such measures were exactly equal to the Porphyry Coffer: while, the intermediate or proximate standards of these things, —which Moses evidently possessed, and his followers carefully preserved, and whose possession prevented any necessity for appealing in their day to the originals in the Pyramid,—lasted with the nation up to the destruction of the Temple by Titus; *i.e.*, for a somewhat longer time than the laws connected with them could be righteously considered in juridical force.

But so far as the Jews' metrology went, it was that of the Great Pyramid.

Instead of then failing, however, the Great Pyramid has gone on lasting for nearly two thousand years, after that historical destruction of the Jewish national interest in its existence; and further, almost one thousand years of this period had elapsed, before the apparently accidental fall of the passage-stone in the times of Caliph Al Mamoun revealed the original of all capacity measure, and the memorial of the days of the sacred week, to the gaze of all mankind. Evident proof this, it may safely be averred from the facts themselves, that the Pyramid metrology, as directed by a higher Power, was not intended to be confined to the Jews alone; even as Mr. John Taylor has shown, that besides the

The Pyramid and its standards have lived long beyond the time required for Jewish metrology.

British hereditary inch and hereditary quarter and chaldron, the chief of the Greek and Roman measures were descended therefrom.

Other nations blindly, received out of the Pyramid, that which was given to the Jews by inspiration.

In short, he would seem to say, and the facts support him, that the Great Pyramid, besides first of all indirectly furnishing the sacred people with the original types of their several measures in justness and truth, was devised likewise for the metrology of all nations; and has been by them unconsciously so employed to a great extent, and continues its existence in the world to declare that purpose, and show forth the means employed. So that, if most nations have lost or bedimmed what they once received of its teachings in distant times,—but, we may say this for them, never received in the same distinct manner that the Jews did,—there is now opened up to all existing peoples the opportunity, by means of the growth of modern science on one side, and the possession of the Bible on the other, of finding out for themselves, in a new and certain manner, the sacred and admirable character of the metrology of the Pyramid;—and then acting upon such knowledge according to the measure of the faith that is in them.

Opportunity for all nations now, to judge for themselves of the value and origin of what they have inherited.

We shall not therefore, here, attempt the useless task of trying to persuade any one, but merely employ the remaining pages in pointing out some few

additional facts, which are useful to know, as groundworks for thought and reflection; as thus:—

Requisites for a centre of general metrology.

In order that any metrological system aiming at general adoption may find equal favour amongst all the powerful nations of the earth,—writes a recent secular author,—it must give no partial preference or advantage to one of those nations over another.[1]

A good remark, and widely true; even as Hungary lasted for centuries so long as no one of its many co-existing nationalities attempted to impose its own language on the others, but fell when the Magyars tried to make their tongue the connecting and official language of the whole country; and the remark is satisfied by the Pyramid in this manner, that in the days of Egypt's power, the metrological characters of the monument were unknown and even absolutely concealed from view; while, in the present day of their near interpretation, what great government of Europe or America is jealous of Egypt,—of modern Egypt,—little more than a vassal to the decayed Ottoman Empire.

Of impartiality in kind, and denomination, to all powerful peoples.

Again writes our secular author: The fountain-head

[1] "And besides these qualities of invariability, indestructibility, and identical reproducibility, it (a *universal* standard) ought to possess some obvious claim to *general* acceptation as of common interest to all mankind, or at least to all the civilized portion of it; an interest from which national partialities and rivalries should be altogether excluded."—*The Yard, the Pendulum, and the Metre*, by Sir J. F. W. Herschel, Bart.

of such a system, and the seat of the very actual and really original standards, should be located in a central and accessible situation, suitable to all the nations who are to employ them.

How is this argument met at the Pyramid?

Of geographical convenience.

The *physical* geography of the question has already been answered in many books; but by none so effectively as that of the French Academicians in the "decades" of their revolutionary era; for thus commences, in large type, the exordium to their so-called immortal volumes, the *Description de l'Egypte*:—

"SITUATED BETWEEN ASIA AND AFRICA, AND COMMUNICATING EASILY WITH EUROPE, EGYPT FILLED THE CENTRE OF THE ANCIENT WORLD."

French opinion upon Egypt as the political centre of the civilized world.

French authority may likewise be quoted touching the equal centrality of the Egyptian country in modern *political* geography also; for thus writes M. Ampere, with G. R. Gliddon's high approval:—

"Egypt, which awakens all the grand memories of the past, interests us yet in the present and the future: in the present by the agonies of her parturition; in the future through the destinies which Europe is preparing for her, so soon as Europe shall have taken possession of her, which cannot very long be retarded (now that the Isthmus of Suez has again become the high-road

of nations, the link which unites the oriental to the occidental hemisphere). . . . Egypt, a country made to occupy eternally the world."

A somewhat opposite idea was indeed a few years ago projected into English literature, and by a great astronomical authority; for he gave out that the city of London was pretty accurately in a central position, with regard to all the presently habitable countries on the face of the globe.

London as the centre of the commercial world.

Inasmuch as that geographical position was considered by its author to explain the astonishing prosperity of London as a port for the shipping of all the world,—there supervened some surprise at the reason alleged, when soon afterwards the calculation was gone into more rigorously, and it was found that the truly central position fell, as nearly as such a quantity could be computed from all its heterogeneous data, not on London, or Liverpool, or Hamburg, or any other wealthy port, or even a port at all, but in the middle of the great sandy desert of North Africa!

Position of that centre, altered to the Sahara.

There the matter was left; but now, seeing that the populous nation of Japan in the far East has been added since then to the commerce of the world, we have little doubt but that the geographer should so rebalance and weigh the conflicting claims to habitable and trading

Opening of Japan, places the centre in Egypt.

importance of different countries, as to push the general computed centre eastward; and very nearly, perhaps quite, as far, as the Pyramid-crowned Valley of the Nile itself.

Of the respective sites of Egypt, and Palestine.

On every side, truly, and by every means,—by land, by sea, and by the through route of its long, long river, —Egypt proves itself to be as admirably adapted for a general and central referring point to all modern nations; as, on the other hand, did the close, secluded, and small-featured character of the hilly Palestine, render that land appropriate to the preservation of a peculiar people for a special and also important end.

Lasting power of the Great Pyramid.

What inimitable care too, was taken, that the Great Pyramid should last down to these latter days in which we live; when its original standards are so much required by the distressed metrology of nations; and when science can explain the advantages and meaning of the included measures. This care is evident, not only in the solidity and low centre of gravity of the huge edifice; but even in its geographical situation, with the accompanying climate, and minerals. For in that proverbially "monumental" land of Egypt, buildings last *naturally* far longer than in any other part of the world: the sandstone having little or no rain to cause it to decay; and the granite being free from those

innumerable geological fissures and dislocations which prevent any very large masses of that rock being raised out of the tormented and shaken beds of Scotland, and many another European country besides. Egyptian climate, and Egyptian rock.

Man, though, is undoubtedly troublesome and untoward enough to the conservation of monuments in Egypt; and therefore, had any new or peculiar form of building been adopted for the grand metrological structure of future times, it would, in its then singularity and isolation, according to all experience, have been speedily destroyed by the people of the land; a people always inquisitive, as well as self-sufficient, and left so soon after its completion in sole possession of the giant gift intended for posterity. But the adoption, by the architect, of a typically pyramidal form,—amongst tribes or nations already beginning to build pyramids, and taking to the practice more than ever, after seeing that memorable example,—tended to lose the external notability of the Great Pyramid amongst many similar structures; and, by their growing numbers, both baffled the choice, and fatigued the hand, of the Vandal destroyer. Precaution against mischief from men.

A very slight alteration too, served to convert the sepulchral pyramid of the Egyptians, into the metrological monument of Shofo and Nou-Shofo. The inclined entrance passage, subterranean chamber, and a Sepulchral Pyramid easily adapted to a metrological monument.

coffer sarcophagus, were already an institution; and if something else was added in the shape of the *ascending* portions in the interior of the Great Pyramid,—these were sealed up from all persons during three thousand years; and even to the few who did see them at the time of their building, they were, to uninspired observers, but modified editions of what existed elsewhere.

The Great Pyramid a parable in stone.

Even, too, after all these parts had, subsequently to the commencement of the Christian era, been brought openly to the attention of men; and after they have now remained before them during the last ten centuries of the world's existence,—there has been found by the natives of Egypt nothing so very distinguished, or valuable, to their minds. For, both internally, and externally, the Pyramid would seem to have been constructed, to be a parable, though in stone; a composition which concealed, at the same time that it was also to set forth, the truth which it contained; and, like other parables, had been thrown in the way of the ungodly; in order that, "seeing they might see and not perceive, and hearing they might hear and not understand." But such a character is not to prevent the great work from ultimately accomplishing for the faithful of nations its prescribed ends; nay, rather it will thereby be enabled to fulfil them.

Both concealing, and showing, the truth.

CHAPTER V.

GENERAL SUMMATION; SECULAR AND SACRED.

LET us now cast a rapid glance over the principal results obtained in the course of our long research.

The Great Pyramid, prehistoric, and anti-idolatrous.

1. The Great Pyramid, a prehistoric and entirely pre-Mosaic monument, had remained sealed in all its more important divisions, from the date of its foundation, up to an advanced period of the Christian dispensation; and was then found, on being opened and examined, entirely free from that accursed thing, which formed the leprosy of the East in ancient days,—idolatry.

Solves a notable problem in pure science.

2. The simple proportions of the almost mountainous sides and base of the Pyramid, have been found to contain a solution of one of the most radical propositions in pure mathematics, and *of constant recurrence in high metrology;* solved, moreover, to a greater degree of accuracy than the progress of science had arrived at, after

a period of two thousand years, in the hands of the intellectual Greeks, and even during the meteor-like blaze of their chief geometrical genius, Archimedes.

Offers an admirable standard of linear measure.

3. The linear measure of the base of this colossal monument, viewed in the light of the philosophical connexion between time and space,—has yielded a standard measure of length which is more admirably and learnedly earth-commensurable, than anything which has ever yet entered into the mind of man to conceive, even up to the last discovery in modern metrological science, whether in England, France, or Germany.

Indicates the true figure of the Earth.

4. The height and area of the base of the Pyramid have shown residual features in the figure of the earth, whose existence has only recently been detected by high mathematicians; and the Pyramid results, though not yet fully interpreted, compete in numerical accuracy with those derived from the best combinations of the longest trigonometrical surveys, which have been carried on in recent years, in various parts of the earth.

5. The Pyramid standard for linear measure,[1] after

[1] In practice, there are, strictly speaking, two linear standards at the Pyramid, though one is merely the half of the other, and is further deducible from the Pyramid by two independent analogies, indicating its intrinsic importance. The larger of the two standards, the *metron* of 50 inches, or the $\frac{1}{10\text{-million}}$th of the earth's polar axis, was employed in arranging the standards of capacity and weight, which evidently should be formed on the earth viewed as a whole. But the smaller, or the *arm* of 25 inches, the $\frac{1}{10\text{-million}}$th of the earth's polar *radius*, deals with only half of

furnishing notable help to astronomers, surveyors, and working men,—leads without a break, or flaw, or any extraneous addition, to standard measures for capacity and weight; which are also commensurable with, or figurative of, the earth in its appropriate qualities to these purposes; and with a completeness of symbolization never witnessed before.

Contains pre-excellent capacity, and weight, measures.

6. The subject of temperature, and its various effects in disturbing metrological systems, is disposed of in the only manner which is likely ever to be considered perfectly satisfactory; and it is in the direction towards which modern science has been tending for many years past; but has been accomplished at the Pyramid with a thoroughness and a success vastly beyond anything which has yet been attempted by the most scientific of the nations of Europe.

Unexceptionable correcting for temperature.

7. And finally,—though finally only as the last subject we have space to mention under this head,—the material of standard measures, a matter in which modern science has been stumbling without knowledge

True material for standard measures.

the earth: a feature which renders it appropriate to all *distance* measuring; where, as in the extreme cases of astronomy, the measurement begins from the *centre* of either the earth, or any other globe or globes concerned. This circumstance makes the largest derivative of the *arm*, or the Pyramid *league*, an interesting junction between astronomical and terrestrial measures; for the mere shifting of the decimal point three places of figures, causes a distance expressed in earth-radii to be given at once in the terrestrial significance of leagues. No such generalization is possible to the French metre.

several times during the present century, is treated in a manner to last for ages; and to bring into useful employment the chief discovery of the youngest of all natural sciences; viz., the long ages of geology.

So far as mechanical perfection is concerned, the above series of instances should be sufficient answer,—as to whether the Pyramid rises up to the point of satisfying the requirements of a general metrological centre, for all nations, in the present highly civilized era of the earth.

Fire-proof and other good qualities of the building, for lasting and safety.

If question be further directed to the probable lasting powers of the ancient monument,—where else, may we ask, is a building, all the wide world over, so absolutely and completely fire-proof; so thoroughly founded on rock; and so difficult to destroy in any manner whatever! Compare it with the Palace of Westminster, which now enshrines the existing British standards of about ten years old; or with its predecessor which so easily gave up to the flames our country's standards of the ten years previous; or, if there be anywhere in Europe a building of even one-fifth the age of the Great Pyramid, kept up without the assistance of modern repairs and renovations, and employed or not employed in preserving standard-measures,—let its component walls be examined, and see how all their

substance is hastening to decay, while the stones of the Great Pyramid keep up their ancient soundness with all the vigour of youth, and are a type of the perennial freshness of nature.

Central position to civilized world.

And if the still further inquiry be made, whether the situation of the Pyramid be sufficiently central to all the populous and active nations of the world, giving fair opportunity to all, and undue advantage to none, —we need hardly repeat here our very recent chapter on this identical subject.

Higher arguments for the Pyramid.

Try it therefore either all in all, or upon any one single count, there is no objection which can be taken in a secular point of view, to the full scientific sufficiency of the Great Pyramid to serve as the centre of metrology for the civilized world. But then, the mere absence of physical objections is not enough to establish a right to noble destinies; and a higher question may therefore very properly be asked,—as to whether there are any similar arguments on spiritual grounds, and such as should touch the hearts and warm the souls of all men, of every tongue and every nation, even after their heads may have been thoroughly convinced?

To this inquiry, let the Pyramid's symbolization of the *week* of seven days, send forth its expressive answer; as well, also, its *length* of the sacred cubit of Moses; and,

Its containing the symbols of the week, the sacred cubit, and the chomer of the Jews.

its *measure* of the Hebrew chomer. Moreover let the Sacred Volume add further unerring testimony, to what science has already asserted, touching the even earth-commensurability of these measures having been a problem entirely beyond the power of men either of the Pyramid day, or of any other day four thousand years therefrom,—*unless they had received the aid of Divine inspiration from on High.* Except for the impossibility of such a work to *early* nations, working on merely with the faculties of men, and the small amount of science accumulated up to that time, why was it then said as a figure of utter hopelessness of accomplishment to man, or as a thing so difficult that he need not attempt it:—

"The measure thereof is longer than the earth, and broader than the sea;"[1]

An impossibility in primeval times, possible now to science.

Though we now know, that *modern* scientific men have measured both the sea and earth over and over again, and that their results are to be seen in all school text-books on geography.

Or why was the Deity made to address Job:—

"Hast thou perceived the breadth of the earth? Declare if thou knowest it all."[2]

But the only answer that Job, one of the chief men of the earth at that time, could return, was:—

[1] Job xi. 9. [2] Job xxxviii. 18.

"Therefore have I uttered that I understood not; things too wonderful for me, which I knew not. Wherefore I abhor myself, and repent in dust and ashes."[1]

The primeval impossibility was once solved, and perfectly, in primeval times,—but not by man.

But precisely that thing, which all mankind from the Creation up to the day of Job, or of Moses, had not accomplished, and had no idea or power how to set about to perform it, and did not make even any rude attempts in that direction during the following 2500 years,—has lately, and only lately, been accomplished in a sure manner, by *modern* science; (we do not say with perfect accuracy, for exact science holds that nothing can be done in practice *perfectly* accurate, but, with exactness quite sufficient to render the compass of the earth in measure, a very familiar quantity in the mouths of all mankind of the present time;)—that thing, then, we repeat, impossible to men in the early ages of the world, proved to have been so to them both on scriptural testimony and scientific grounds, was nevertheless on one very remarkable occasion, many centuries before Moses, most certainly, as well as successfully performed; and the results are still to be seen to this day in the Great Pyramid. But in such case the human impossibility must evidently have been

[1] Job xlii. 3, 6.

Testimony that Divine inspiration overcame the human impossibility.

overcome by Divine means; and history indicates that it was so, but accompanied by this strange feature, viz., that although Egypt had been chosen as the country where the favoured monument was to stand and preserve important truths for a future day, no Egyptians, and indeed no men of any nation whatever, save only a few of the Hebrews, inspired writers of the Old and New Testaments, became acquainted with its contents.

That solution was known to the inspired writers of both Old and New Testaments.

That these inspired authors had a general knowledge and high appreciation of what had been, as it were, performed on the earth, and included in the Pyramid, appears, amongst many other forms of proof, from the religiously honourable allusions to the figure, construction, and mechanical building of that edifice, contained in their sacred writings. Even the above-quoted challenge to Job may be almost regarded as proving, on the usually received principles according to which such challenges are given, that an earth-measure, if not actually made by, was known to, him, who was then personifying the Almighty Speaker; while the closely accompanying descriptions, in the same chapter, of the foundation of the world, in terms applicable alone to the establishment of the Great Pyramid by measure on its rocky hill, give a memorable localization to the quantities then obtained or imparted.

And connected by them with the building of the Great Pyramid.

In Isaiah, too, the same idea is carried on further, so that one hardly knows, from the words themselves, whether it is asked, with a limitation of course to the period, or near it, at which the saying was addressed to the Jews,—*who,* amongst men, has ever succeeded, or could expect to succeed, in accomplishing the received impossibility of that day; or, whether the Prophet gives forth as information, that it is the Lord who has done this acknowledged wonder, viz.:— Example from Isaiah.

"Who hath measured the waters in the hollow of his hand, and meted out heaven with the span, and comprehended the dust of the earth in a measure, and weighed the mountains in scales and the hills in a balance?"[1]

The note of interrogation, however, at the end of the verse, shows that the question was really asked; and what could be more eminently descriptive of the various steps by which, during the last few years, the British nation has been measuring the attraction of mountains, and weighing the substance of hills in a scale, in order to arrive at a knowledge of the "mean density of the earth;" that invaluable quantity, which appears to have been introduced into the capacity and weight measures of the Pyramid, at a time when it was an utter impossibility Typification of the mean density of the earth.

[1] Isa. xl. 12.

to men; though now, the growth of physical science since the time of Isaiah, has enabled us to appreciate the importance of such an introduction, and even to estimate the numerical accuracy.

Two concluding reflections.

From this point it is futile for us to do more than merely allude slightly to two lines of reflection which emanate thence.

Of metrology as a pre-Mosaic revelation.

The first is, When so many are the indications of Divine inspiration having both suggested and given its characteristic perfection to the metrology of the Great Pyramid,—that system of which the *hereditary* British measures still preserve some very recognisable traces, even after the abrading effects on tradition of 5000 years,—what course is the religious public likely to take? Will they, on the one hand, either give way before the bullying of French writers and the wheedling of the Anglo-French traders amongst ourselves, consenting to throw from them their national measures, derived from such an origin and adhered to for ages so faithfully by our forefathers, in favour of a recently human-devised system from Paris?—or, on the other hand, will they tamely allow our own Government, by their acts, not only despising the example of antiquity and contemning the importance of posterity, but going on perseveringly with their metrologically atheistic

The system intended eventually for all nations.

schemes, to pervert the character of a language-like primeval gift to our race, and neutralize for the whole nation a hereditarily-received share in some of the teachings and aids to performance in the Old Testament, intended for a wider range of humanity than the particular people to whom they were first addressed?

The signs of the present age.

The second prompting for reflection is, That Scripture does not now indulge its readers with a prospect of a very long uninterrupted progress of human dominion in the world. Wars and commotions are often alluded to as symptoms of the coming end; also when knowledge shall be increased, and many shall run to and fro. Yet these signs have been for centuries so numerous, as to throw a haze of indistinctness forward from their own time, which may obscure the real signs when they shall at last arrive. But if we find that science has already run so continually and effectively over the earth, that men have acquired thereby an exact knowledge from actual measure, of those geographical problems which at the time of the Mosaic legislation were put forward as being characteristic of impossibility; if they have now accomplished this step which was set before them in the infancy of the world by their Heavenly Parent *to* accomplish; and if men have recently had the contents of the pre-Abrahamic, as well

Its accomplishment of a previous impossibility.

The opening of the long concealed mysteries of the Pyramid.

as pre-Mosaic, monument of an *unwritten* Divine Revelation opened to them; and have found out by the legitimate application thereto of modern physical science, a reason why Moses regarded certain things as sacred; or rather, have obtained a proof that those things which he regarded as sacred, must have been derived from a higher than any human source, and are, therefore, to be preserved as the apple of our country's eye;—and if, on the other hand, another European nation, which has already succeeded in persuading half the kingdoms of the earth to receive her devices, is ready just now to take political offence (so inevitably productive of war at last), should Great Britain not hasten, on being bid, to annihilate every remnant of her high inheritance, and bind in its place the lowering inventions of that people on her brows from this time forth for ever,—may not these be symptoms that the stormy beginning of the first end is nigh at hand, the present dispensation nearly concluded, and a new one with more exalted ends and of a wider significance, not far from commencing?

Contentions thereupon amongst nations.

THE END.

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